chapter 2

Growth, Deregulation, and Intermodalism

"Looking into the future, we have to change our attitudes about transportation. This is the biggest challenge of transportation."

Congressman James Oberstar
2025 Visioning Session, San Jose, CA, June 24, 2000

"The transportation enterprise must get smarter, marrying new technologies with new innovative financing techniques."

Professor Joseph Giglio, Northeastern University
2025 Visioning Session, New York, May 18, 2000

"In the next 25 years, the challenge we will face is inertia or the unwillingness to try to do new things."

Roy Kienitz
Executive Director, Surface Transportation Policy Project
2025 Visioning Session, Saint Louis, Missouri, June 13, 2000

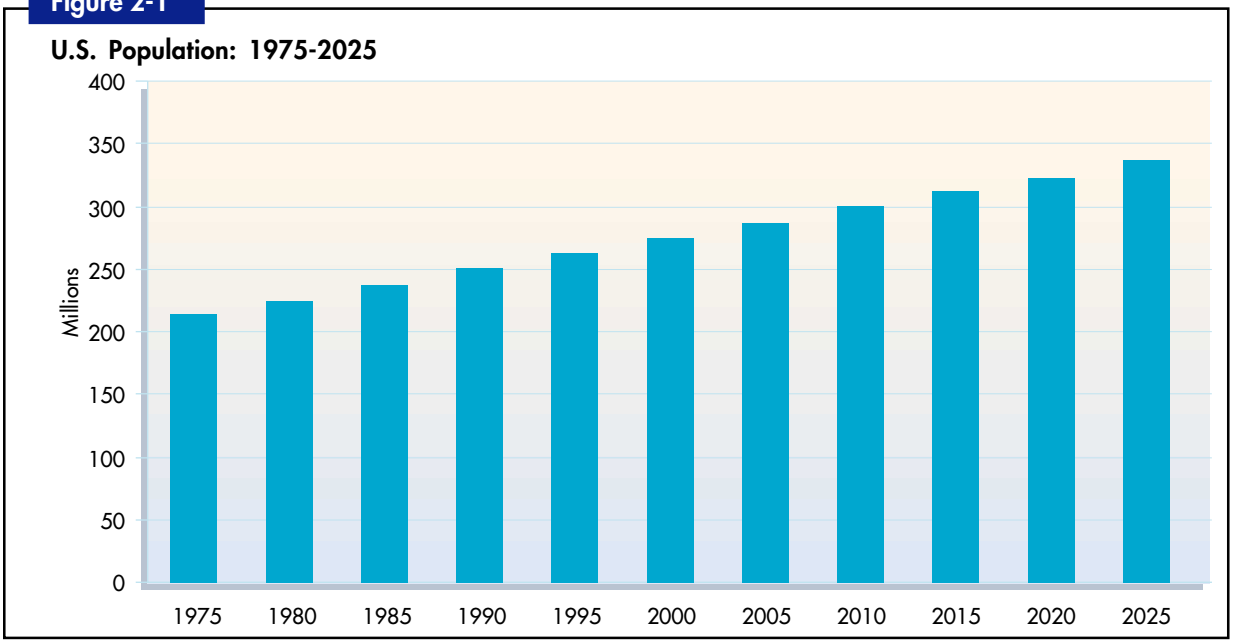
chapter 2

Growth, Deregulation, and Intermodalism

Over the past quarter century, the American transportation system changed dramatically in size and form as it carried ever-increasing numbers of passengers and volumes of freight, both domestically and internationally. A steady increase in population (figure 2-1) coupled with strong economic growth (figure 2-2) is largely responsible for tremendous demand for transportation services today.

Figure 2-1

U.S. Population: 1975-2025

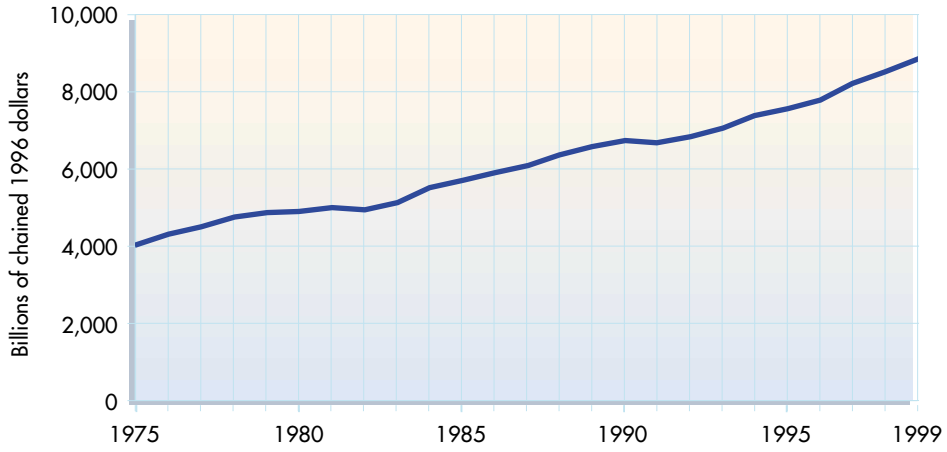


Note: Middle series projection.
Source: U.S. Department of Commerce, U.S. Census Bureau, *Statistical Abstract of the United States 1999* (Washington, DC: 1999). Projections: U.S. Department of Commerce, U.S. Census Bureau. *Annual Projections of the Total Resident Population as of July 1: Middle, Lowest, Highest, and Zero International Migration Series, 1999 to 2100*, available at http://www.census.gov/population/projections/nation/summary/np-t1.txt, as of Sept. 3, 2000.

Other forces also have had a significant impact on the way our transportation system has grown and the shape it has taken. Deregulation of the transportation industry is one such force. Deregulation of the aviation, rail, motor carrier, and maritime shipping industries over the past 25 years opened the door to thousands of new competitors, creating an environment that spawned innovative, efficient, and affordable transportation services, which supported a rapidly globalizing economy. Subsequently, globalization enabled growth of a transportation system that, today, spans every corner of the world.

Figure 2-2

Economic Growth in the United States: 1975-99 (Gross Domestic Product)



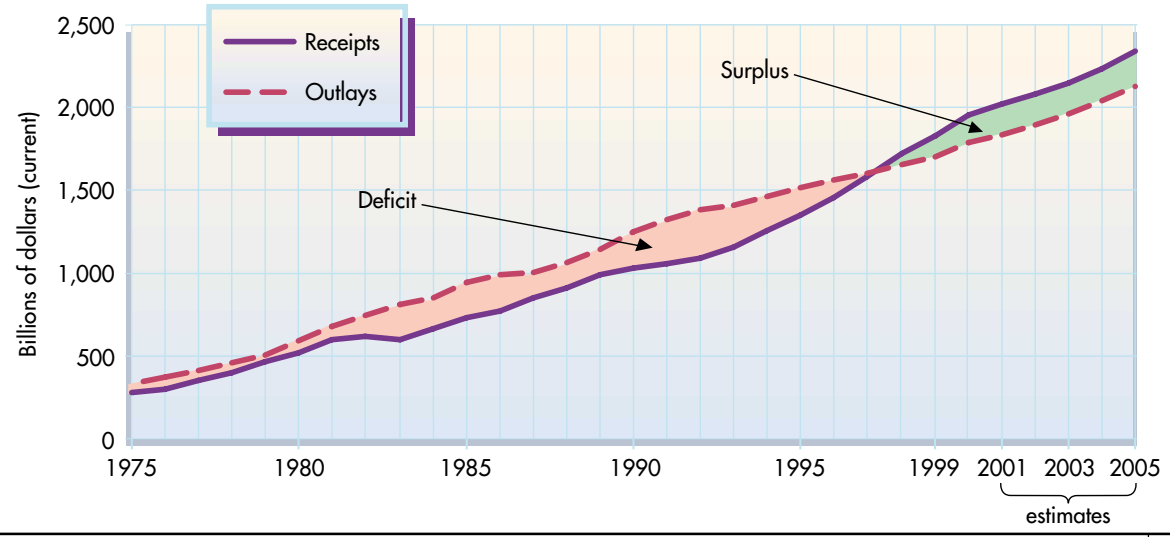
Source: U.S. Department of Commerce, Bureau of Economic Analysis, National Accounts data, available at http://www.bea.doc.gov/bea/dn/gdplev.htm, as of Aug. 24, 2000.

Intermodalism in the freight industry—the seamless movement of goods by several transportation modes on the same journey—is another significant change that has influenced the growth of the transportation system in the last 25 years. One of the most visible manifestations of intermodalism is the growth in container traffic, spurred by technological advances and the search for faster and cheaper ways to transport freight across the globe. Innovative ways of doing business—just-in-time manufacturing and delivery and supply chain logistics—demand intermodal movement within a guaranteed timeframe. While these changes are reverberating throughout the entire transportation enterprise, other factors are also influencing the growth of our transportation system:

1. Federal budget deficits, which peaked during the 1980s and early 1990s (figure 2-3), reduced the available funding for building and maintaining transportation infrastructure. But by the late 1990s, the budget deficit was significantly reduced, and in recent years, unprecedented levels of public investment have been made in new transportation infrastructure. Projected federal budget surpluses over the next decade may result in even higher funding levels. The recently enacted U.S. Department of Transportation (USDOT) appropriations budget of $58.5 billion is the largest in the Department's history.
2. Communities concerned about transportation's impacts on their quality of life, particularly economic development, environment, land use, and congestion, have increased decisionmaking authority over how transportation funds will be spent in their areas. Little by little, these decisions have helped shape the national transportation system. Recently enacted surface and aviation transportation reauthorization measures increase the opportunity for public participation.
3. Technological innovations in the highway, rail, air, pipeline, and maritime transportation industries have made transportation cheaper, more productive, and, in many cases, faster. Transportation is also safer, with fatality rates dropping on our nation's highways,

Figure 2-3

Federal Budget Outlays and Receipts: 1975-2005



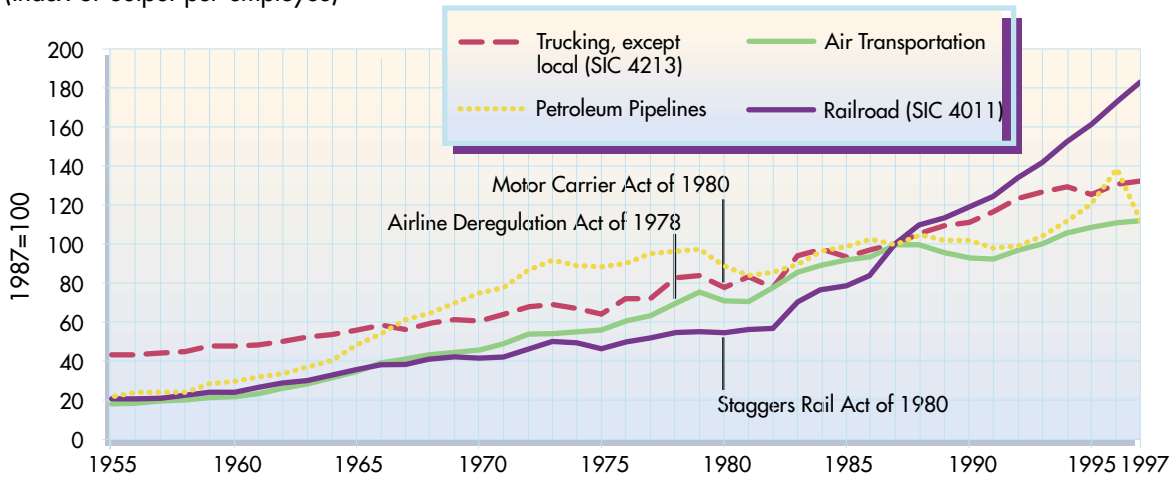
Source: U.S. Office of Management and Budget, Congressional Budget Office, *Historical Tables* (Washington, DC: Annual issues).

among recreational boaters and maritime workers, on the rails, in the skies, from pipeline mishaps, and from hazardous materials discharges. On the whole, our transportation system is the safest it has ever been.

The three interlinked trends—transportation system growth, deregulation, and intermodalism coupled with economic growth, increased funding for infrastructure, and technological innovations—reshaped the transportation enterprise in the last quarter century and produced enviable productivity gains across all modes of transportation (figure 2-4). The following sections, beginning with Growth of the Transportation System, trace each of these trends and their impacts in the last 25 years.

Figure 2-4

Productivity Trends for Transportation Industries: 1955-97
(Index of output per employee)



Source: U.S. Department of Labor, Bureau of Labor Statistics, Office of Productivity and Technology, December 1999.

Growth of the Transportation System

In the past two decades, the focus of transportation shifted from building transportation systems to adapting and modernizing transportation facilities and services. Growth during this period has largely been in *use* of the transportation system. People are traveling more frequently and more often for personal and business trips, and increasing numbers of people are vacationing and working in other countries. In business and industry, domestic and international companies have spurred an increase in the movement of freight around the world.

"Together, the united forces of our communication and transportation systems are dynamic elements in the very name we bear—United States. Without them, we would be a mere alliance of many separate parts."

General Dwight D. Eisenhower

The interlocking elements of the U.S. transportation system support 4.5 trillion miles of passenger travel and about 3.7 trillion ton-miles of goods movement. The system includes more than 5.5 million miles of public roads, railroads, waterways, and oil and gas pipelines; over 19,000 public and private airports; and 230 million motor vehicles, railcars, aircraft, ships, and recreational boats. Growth and change have been experienced in several elements of the U.S. transportation system:

- Highway travel is the predominant mode of transportation for both passengers and freight. The number of vehicle-miles traveled now exceeds 2.6 trillion miles, and continues to grow at a rate of about 2.5 percent per year. More freight is moving on the highways than ever before. [USDOT BTS 1997a; USDOC 1977].

- Transit encompasses a wide range of vehicles, services, and settings. There were approximately 6,000 transit systems in the United States in the late 1990s [APTA 2000]. Ridership in 1999 reached 9 billion trips—the highest since the 1964 level of 10.4 billion.

Seven of the top 10 Public Works Projects of the 20th Century (in no particular order) were transportation related:

- **Bay Area Rapid Transit District (BART)**
- **Tennesse Valley Project**
- **Panama Canal**
- **Interstate Highway System**
- **Reversal of the Chicago River**
- **St. Lawrence Seaway/Power Project**
- **Golden Gate Bridge**

The other three projects are the Grand Coulee Dam & Columbia River Basin Project; Hoover Dam, Boulder Canyon; and Hyperion Treatment Plant.

American Public Works Association,
Top Ten Public Work Projects of the Century
www.pubworks.org

- Once the country's leading provider of intercity freight and passenger transportation, the railroad system continues to be one of the nation's principal modes of transportation, although its share of both the freight and passenger market has declined considerably. In 1977, railroads accounted for 37 percent of the freight ton-miles. About 3 percent of all intercity passengers traveling on public carriers use rail service, compared with 5 percent in 1977.

- Commercial airports operating in the mid-1970s serviced 4.5 million flights. By 1999, the number of flights handled at those same airports nearly doubled to 8.5 million. Passenger traffic has nearly tripled since 1975.

- The U.S. Marine Transportation System consists of waterways, ports, and their intermodal connections. Each component is a complex system within itself and is closely linked with the other components. Since 1975, domestic shipping has grown 16 percent by weight while waterborne foreign trade increased by 65 percent by weight. It is expected that these volumes will more than double over the next 20 years.

The following sections highlight the growth across all transportation modes in the last quarter century.

Highway System

The United States highway network consists of 4 million miles of roads and streets. Highway bridges also comprise a critical link in the nation's infrastructure. At present, there are about 600,000 bridges on the entire highway network [USDOT BTS 1999]. State and local governments control most roads and bridges in the United States, but all highways serve as part of an integrated national network.

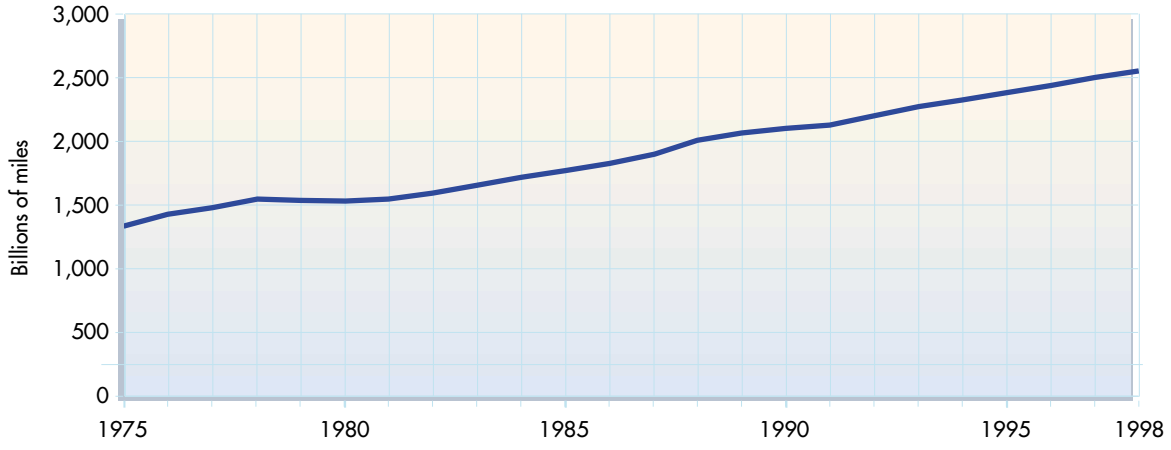
The Interstate Highway System (IHS) accounts for only one percent of all highway mileage, but carries 25 percent of the total vehicle miles of travel (VMT) [USDOT FHWA 1998]. With the completion of the Interstate System in the 1980s, the focus shifted toward maintaining and improving the system, improving traffic flow, and upgrading intermodal connections.

Growth in the number of drivers and cars, an increase in the number of trips per household, and increased freight movement are all contributing factors to growth in highway use over the last 25 years.

In the mid-1970s, the IHS had been under construction for nearly two decades, and 37,000 of its 42,500 miles were open to traffic. The advantages of the IHS were being felt across the entire country, and travel was increasing. Since 1975, VMT on the nation's roads has doubled (figure 2-5). Figure 2-6 shows the change in VMT per capita for various states between 1975 and 1998.

Figure 2-5

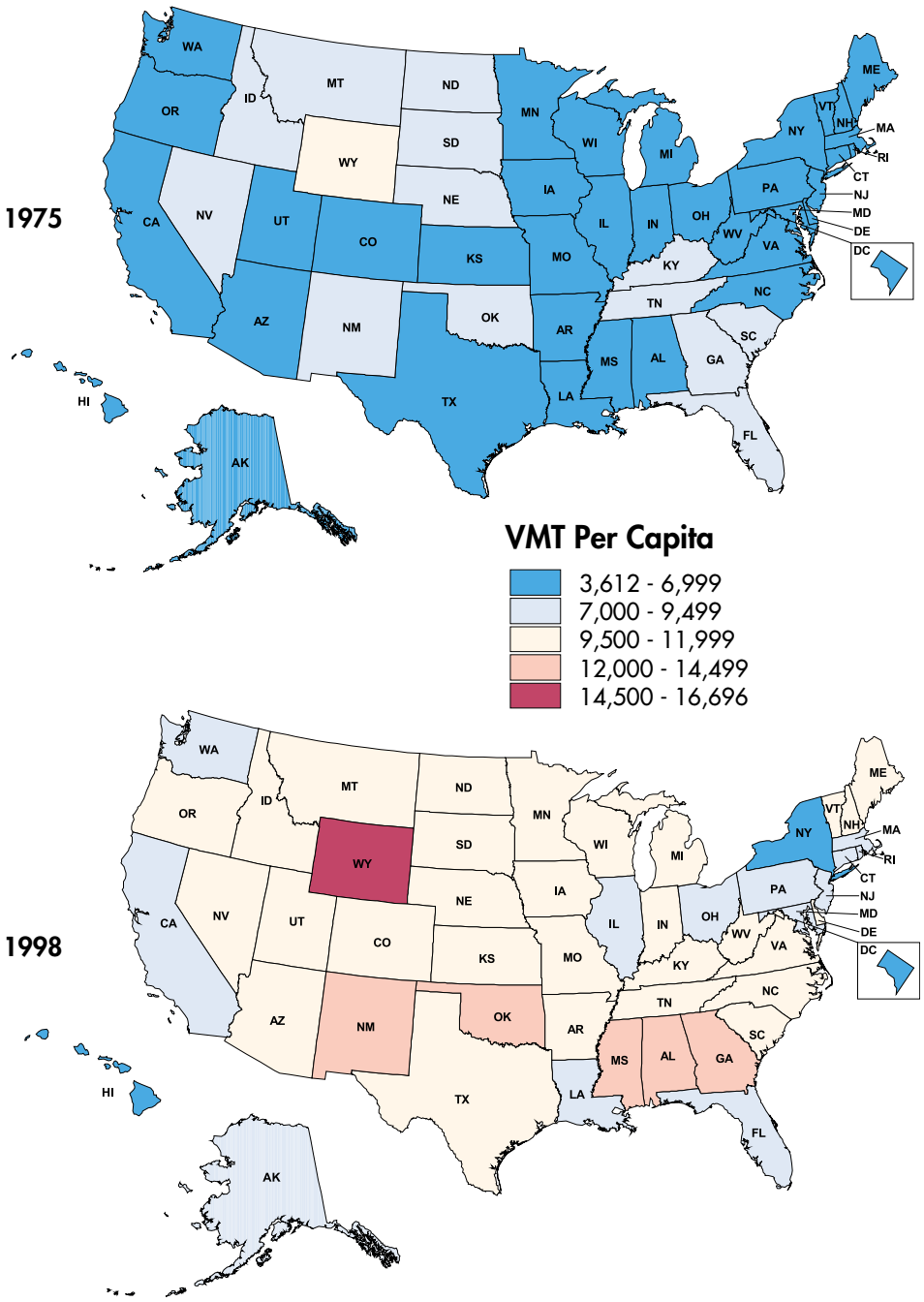
Vehicle-Miles Traveled (VMT): 1975-98 (Annual totals)



Source: U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics* (Washington, DC: Annual issues).

Figure 2-6

Vehicle-Miles Traveled on Highways: 1975 and 1998



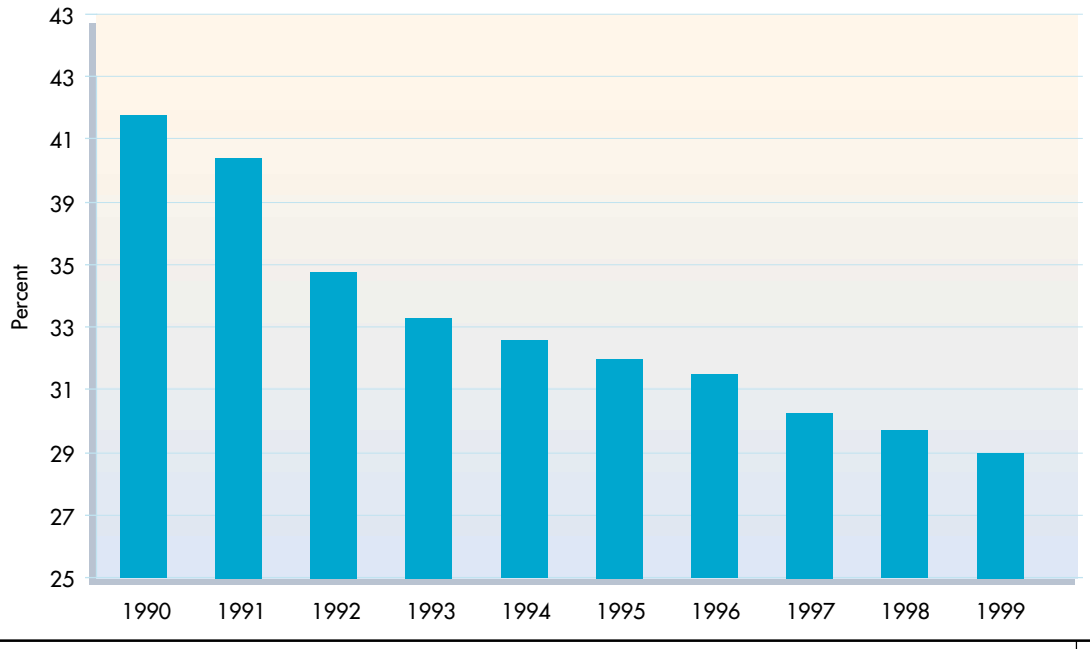
Source: U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics* (Washington, DC: 1975 and 1998).

Under the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991, a National Highway System (NHS) was designated in 1995 comprising the completed IHS, urban and rural principal arterials, other strategic highways, and intermodal connectors. The NHS is 161,117 miles long—just 4 percent of the total highway miles—but carries 43 percent of the total VMT [USDOT 1999b]. Because of its network of intermodal connectors, which tie all

transportation modes together as one, the NHS serves as the backbone of our nation's transportation system. ISTEA, and later the Transportation Equity Act for the 21st Century (TEA-21), enacted in 1998, provided a record level of funding for highway programs. According to a 1999 Federal Highway Administration (FHWA) study, increases in funding have improved Interstate pavement quality. In 1999, nearly 92 percent of the NHS pavement had acceptable ride quality [USDOT 1999b]. The NHS also includes 130,000 bridges, and only 23 percent of these were rated deficient—structurally deficient or functionally obsolete—in 1999. Of the nearly 600,000 bridges on all roads nationwide, about 29 percent were found to be structurally or functionally deficient in 1999, an improvement over the 42 percent that were deficient in 1990 (figure 2-7). FHWA data are confirmed by the American public. In a recent highway user survey, satisfaction with pavement condition increased from 48 to 60 percent of adult drivers "satisfied" between 1996 and 2000. Similarly, their satisfaction with bridge condition increased from 58 to 77 percent "satisfied" during that same period.

Figure 2-7

Percentage Deficient Bridges of Total Bridges: 1990-99



Source: U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics* (Washington, DC: Annual issues).

Increased highway use led to growing congestion on our highway network, especially in and around urban areas. The FHWA's calculation of volume/capacity ratio, which compares peak-hour traffic to the theoretical capacity of the highway, found that more than half of peak-hour traffic in urban areas occurs under congested conditions, and the severity is increasing. Delay on the NHS costs billions annually in lost wages and wasted fuel [USDOT 1999b]. Congestion also affects air quality.

Studies at the Texas Transportation Institute (TTI) show that mobility in urban areas is getting worse. Recent analyses show that the average increase in delay per driver for 68 urban areas was 181 percent between 1982 and 1997 and 29 percent between 1992 and 1997 [USDOT 1999b]. Based on daily traffic volume per lane, travel in congested conditions has doubled since 1982 (figures 2-8 and 2-9).

Box 2-1

ISTEA/TEA-21

The Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) created a surface transportation program with flexible funding that created new opportunities to address statewide and urban transportation problems. ISTEA authorized $151 billion over six years for highways, mass transit, and safety programs.

The Transportation Equity Act for the 21st Century (TEA-21), signed into law on June 9, 1998, by President Clinton, built and expanded on ISTEA policies and programs. TEA-21 guaranteed a record $200 billion in surface transportation investment for highways, highway safety, transit, and other surface transportation programs from FY 1998 through FY 2003. Contrary to earlier predictions, TEA-21 continued all major ISTEA programs and added a number of new programs to meet specific safety, economic, environmental, and community challenges. Other special programs include:

- the Transportation and Community and System Preservation Program,
- the Transportation Infrastructure Finance and Innovation Act (TIFIA),
- the Access to Jobs and Reverse Commute, and
- the Rural Transportation Accessibility Program.

Although TEA-21 retains the basic structure established by ISTEA, it does include some important changes. Two of the most significant achievements of TEA-21 are: 1) guaranteed funding; and 2) the continuation and expansion of the landmark environmental programs created by ISTEA.

TEA-21 also strengthens the planning requirements, expands the flexible funding provisions, and places a stronger emphasis on safety. It includes some new programs, such as funding for border crossing and trade corridor activities, to improve freight movements. It continues special provisions for hiring women and minorities, the Disadvantaged Business Enterprise requirement, and labor protections such as the Davis-Bacon prevailing wage guarantee.

Box 2-2

Surface Transportation Financing

The Federal-Aid Highway Act of 1956, coupled with the Highway Revenue Act of the same year, established the Highway Trust Fund, into which a 3 cents per gallon fuel tax was deposited (in 1959, this was increased to 4 cents per gallon). Thus, the mechanism for financing expanded highway programs was created. The 1960s and 1970s saw no changes to this financing, but many changes were made in the 1980s and 1990s:

- The Surface Transportation Assistance Act of 1982 increased the motor fuels tax to 9 cents per gallon and allocated a portion of that fuel tax equal to about a penny per gallon to mass transit programs.

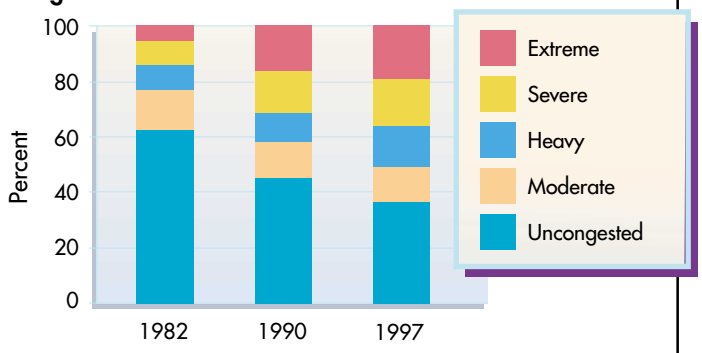
- Another increase of 5 cents per gallon—increasing the federal fuel tax to 14 cents per gallon—was enacted as part of the Omnibus Budget Reconciliation Act of 1990. For the first time in the history of the Highway Trust Fund, half of the revenues derived from this additional 5 cent fuel tax increase went to the general fund of the Treasury for deficit reduction. The general fund portion of the tax was imposed on a temporary basis through September 30, 1995.

- Another fuel tax increase of 4.3 cents per gallon was enacted effective October 1, 1993, with the entire increase directed to the general fund of the Treasury for deficit reduction. In addition, the 5 cents enacted in 1990 was extended and all directed to the Highway Trust Fund. So, fuel taxes deposited in the Trust Fund totaled 14 cents per gallon, with 2 cents dedicated to funding mass transit programs. Overall, taxes totaled 18.3 cents per gallon.

- The Taxpayer Relief Act of 1997 redirected the 4.3 cents general fund tax to the Highway Trust Fund, effective October 1, 1997. The Transportation Equity Act for the 21st Century (TEA-21) linked highway and transit spending directly to tax receipts. Of the 18.3 cents per gallon total, 2.86 cents is dedicated to funding mass transit programs.

Figure 2-8

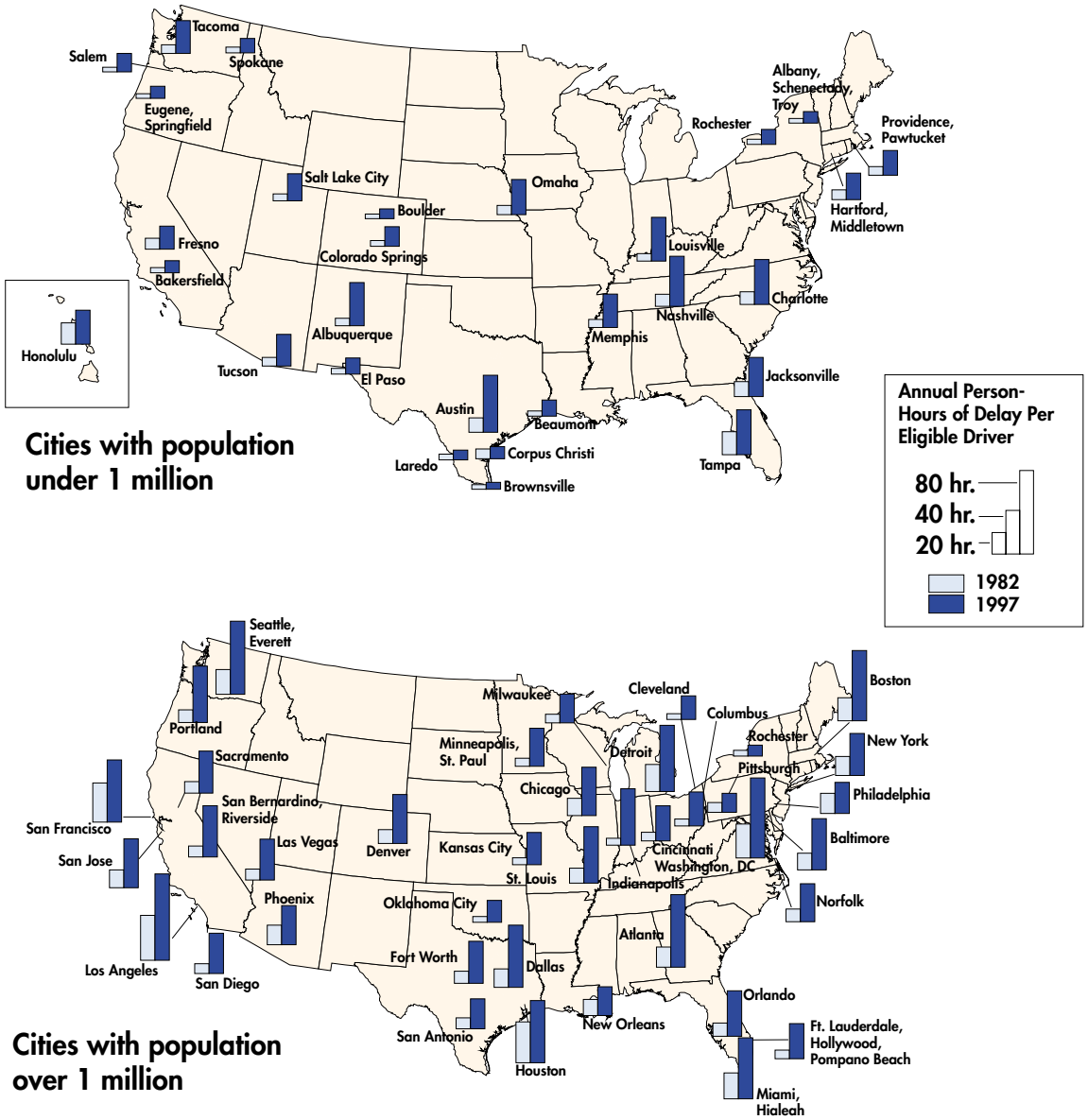
Congestion in 68 Urban Areas: 1982-97



Source: Texas Transportation Institute. *The 1999 Annual Mobility Report: Information for Urban America* (College Station, Texas: 1999).

Figure 2-9

Annual Person-Hours of Delay Per Eligible Driver: 1982 and 1997



Notes: An eligible driver is someone 16 years and older who is eligible for a driver's license. The cities shown represent the 50 largest metropolitan areas, as well as others chosen by the states sponsoring the study. For a detailed explanation of the formulas used, see the source document.
Source: Texas Transportation Institute, *Urban Roadway Congestion Annual Report* (College Station, TX: 1998).

Box 2-3

Telecommuting

Emerging technologies, including the computer, the Internet, and cellular telephones, are providing opportunities to work anywhere, anytime. Telecommuting, as this phenomena is known, is changing the way people live and work, including how, when, and where they travel. In fact, transportation issues have played a key role in spurring the growth of telecommuting. Gasoline shortages in the 1970s led to the recognition that working at home as a substitute for driving to work could save gasoline. Federal legislative acts such as the Clean Air Act Amendments of 1990 spurred the growth of telecommuting as a transportation demand strategy to reduce congestion and air pollution (see figure 2-10).

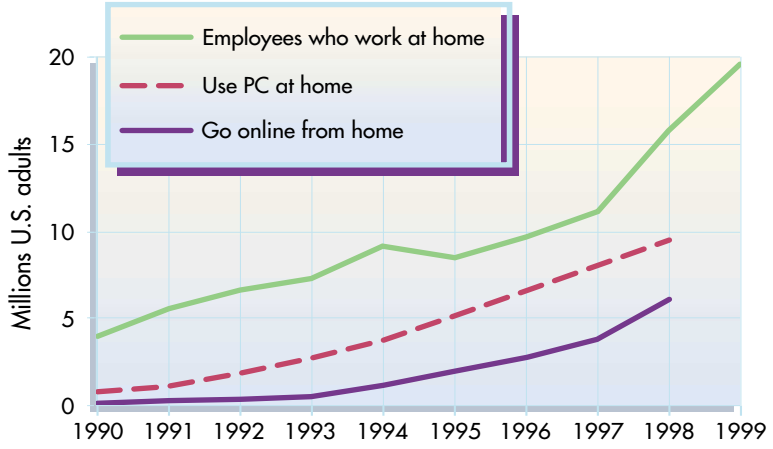
The Clinton-Gore Administration strongly promoted telecommuting. The National Telecommuting Initiative, endorsed by President Clinton's Management Council in January 1996, has resulted in a significant increase in the numbers of federal employees who telecommute.

Another Clinton-Gore initiative, the Commuter Choice Initiative, promotes a greater range of employer-provided commuting options designed to reduce traffic congestion, improve air quality, and allow employers to tailor transportation benefits to their individual employees' needs. This program has made it easier and more economical for people to get to work and has been shown to increase employee satisfaction, improve employee retention rates, and make employers more competitive.

Apart from increasing lane miles of highway (difficult to do in urban areas where congestion is most severe), approaches to mini–mizing congestion include telecommuting (box 2-3), work schedule changes, and the use of Intelligent Transpor–tation Systems (ITS).

Figure 2-10

New Technologies Drive Growth of Work at Home: 1990-99



Source: Joanne H. Pratt, *Cost/Benefits of Teleworking to Manage Work/Life Responsibilities*, report prepared for The International Telework Association & Council, Washington, DC 1999; Thomas E. Miller, *Recent Trends in Telework*, 1990-1998, data available at www.cyberdialog.com, as of July 2000.

ITS uses electronic information and communication technologies to augment the capacity of existing highway infrastructure. Examples of such systems include freeway management, arterial management, traffic signal control, electronic toll collection, transit management, and regional multimodal traveler information. These systems are explained in detail in Chapter 6, Technology.

Keys to the Future

Our highway system ranks as one of the top 20 engineering marvels of the 20th century because of the freedom of mobility it provides to people [NAE 2000]. While significant improvements have been made in the last quarter century to improve pavement and bridge conditions and to improve the mobility of people and movement of goods, there is continued need for emphasis on developing better road construction, repair, and maintenance technologies.

There also is a need to take further steps to ease congestion in urban areas. A variety of strategies will be used to address capacity issues. If we remain visionary and vigilant and make prudent investments, congestion levels in 2025 will be much lower than they are today. Increasing the rate of deployment of ITS technologies will enhance capacity and help enable the effective, real-time intermodal operation of the surface transportation system. Vehicle-based technologies will facilitate high-density traffic flow. Continuous collection of real-time data on the performance of the transportation system and on projected demand will enable innovative strategies and services such as telecommuting, preferential treatment for high occupancy vehicles, and value pricing of transportation infrastructure.

By the year 2025, we will have moved substantially beyond today's modal perspective of transportation to one that views transportation as a seamless integration of transportation technologies, with the highway system as its backbone. A person-trip will be perceived as being from door to door and movement of goods as being from factory to point of retail or consumption, regardless of the number of modes used. Our highway system will be the backbone. The highway system's success in this role will result from a series of strategic research programs spurred by the Transportation Research Board's "Future Strategic Highway Research Program," which will yield more durable and efficient pavement and bridge technologies requiring less construction/reconstruction time, and fewer and shorter construction zone delays and traffic constrictions.

This holistic view of transportation and the implementation of ITS and construction technologies will yield a focus that centers on the efficient operation and management of a mature highway network.

There are ongoing efforts to collect remote sensing data for traffic management, infrastructure management, hazards and disaster assessment, and environmental impact assessment. By 2025, such data would be seamlessly integrated with data collected from ground-based sensors as part of ITS to enhance region-wide traffic management, safety, and efficiency of the entire transportation system.

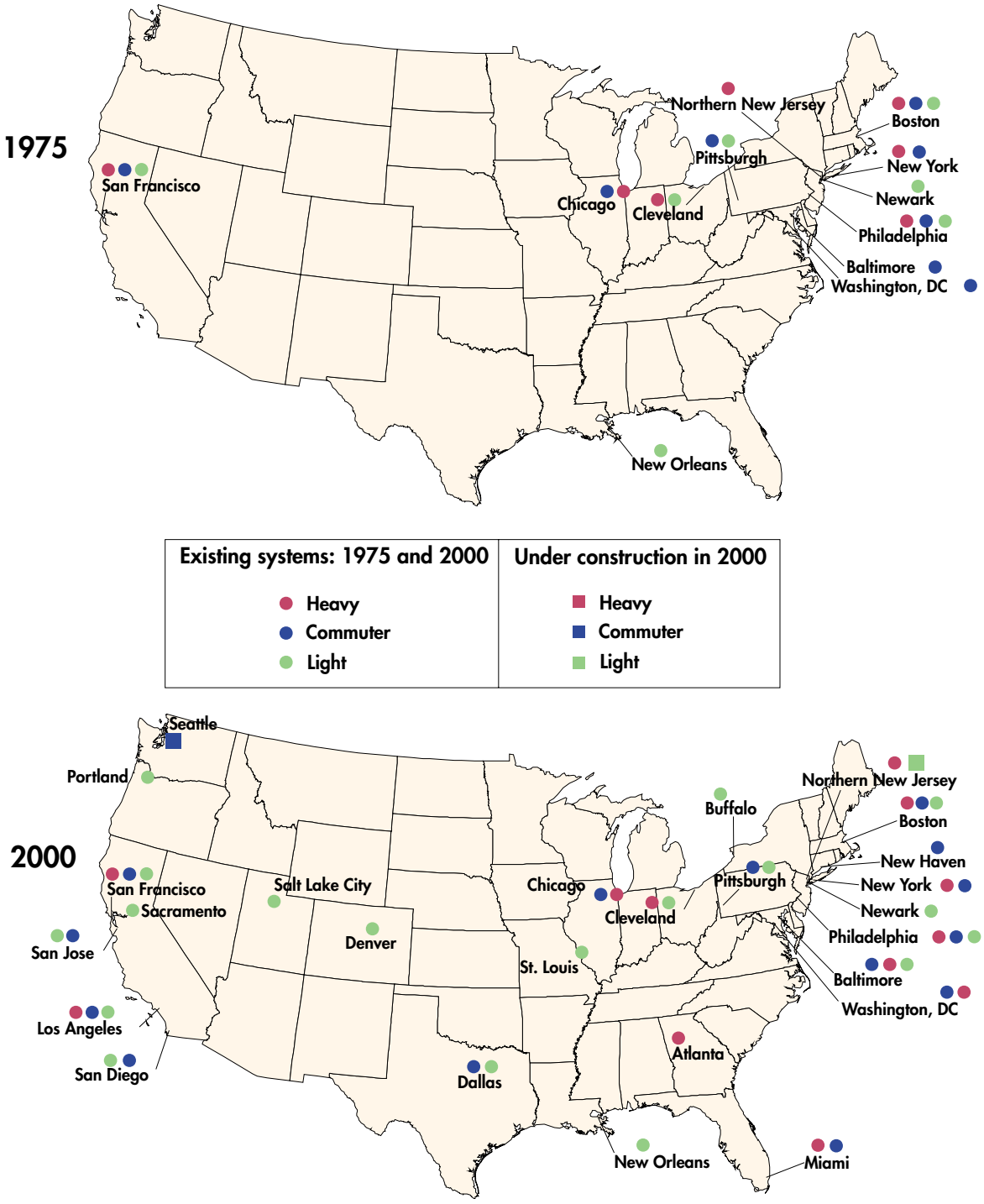
Transit

The U.S. transit system includes a variety of multiple-occupancy vehicle services designed to transport customers on local and regional routes. These services are operated by more than 5,000 public transportation systems throughout the United States and include rail, road, and water modes. Currently, the public transportation fleet comprises 129,000 vehicles in active service, of which 58 percent are buses, 26 percent are demand-responsive vehicles, 8 percent are heavy rail cars, 4 percent are commuter rail cars, 1 percent are light rail cars, and 3 percent are all other modes. In 1998, Americans made 8.7 billion passenger trips on transit with 61 percent of the trips on buses, 27 percent on heavy rail, and 8 percent on commuter and light rail.

Beginning in the 1960s, local public agencies were created to take over the transit operations of financially distressed private transit operations. Federal funds were made available for capital purchases in 1964. In the mid-1970s, the nation's transit systems were hoping to reverse years of ridership decline with a new program of operating assistance from the federal government (National Mass Transportation Act, 1974). Public involvement stemmed from the fact that transit systems provided mobility options for many people who were unable to travel by automobile due, for example, to income, disability, or age. In many areas, transit plays a role in strategies for mitigating congestion and air pollution. Some communities are also emphasizing transit as a means to reduce the negative effects of urban sprawl and enhance the quality of life, a core strategy of the Clinton-Gore Administration's Livable Communities Initiative (see box 5-11 in Chapter 5).

Figure 2-11

Urban Rail Systems in the United States: 1975 and 2000



Source: U.S. Department of Transportation, Federal Transit Administration, special tabulations, October 2000.

Between 1975 and today, two developments in U.S. urban transit service are notable. The first is the increase in the number of cities served by rail transit. Much of the growth in rail transit has been in new light rail systems (figure 2-11), including systems in Baltimore, Buffalo, Denver, Long Beach (California), Portland (Oregon), Sacramento, San Diego, San Jose, and St. Louis. In the late 1970s, Atlanta, San Francisco, and Washington, D.C., added to their heavy-rail systems, while Los Angeles began service on a new heavy-rail line in 1994. Miami and New Haven (Connecticut) added commuter rail service during this period, while Los Angeles and Washington, D.C., extended commuter rail services begun during the previous decade.

The second major development in the past quarter century is the expansion of bus transit service to lower density suburbs as a response to continued decentralization of population and employment within U.S. metropolitan areas. Suburban service extensions in many metropolitan areas were facilitated by the creation of regional transit authorities, which typically extended routes into previously unserved areas to secure a broader geographic base. Many smaller urban areas also established new services, often in response to concerns about automobile-related air pollution and energy consumption, or the mobility of transportation-disadvantaged groups. Today, there are more than 100 miles of transit lines under construction—the most since Woodrow Wilson was President. Additionally, 42 new projects are being designed and more than 100 being planned; demand for federal investment in transit facilities greatly exceeds available and anticipated funds. Ten communities are exploring the potential for bus rapid transit to achieve mobility, environmental, development, and community livability goals at a lower capital cost than light rail transit.

Over a 10-year period, from 1988 to 1998, federal, state, and local investments in transit have nearly doubled from $3.8 billion to $7.1 billion. State and local governments increased their annual transit investments from $1.36 billion to $3 billion, while federal participation increased from $2.5 billion to $4.1 billion. In addition to continuing record-level federal funds for transit investments, the ISTEA of 1991 and TEA-21 provide state and local governments with the flexibility to use specific highway funds to support transit investments. Over the past eight years, state and local governments have taken advantage of this flexible funding option, choosing to use a total of $4.9 billion of highway funds for transit.

Besides providing increasing levels of financial support for transit, communities are acting to maximize the use of transit facilities by implementing a host of transit-oriented policies, such as zoning ordinances that encourage transit-oriented, mixed-use developments, joint developments that generate revenues and riders, policies that enable employers to support a variety commuter options, and fare policies that target specific travel markets for transit. Communities are also seeking to maximize the productivity of their transit operations through the use of ITS , such as automatic vehicle locator (AVL) systems and "smart" fare cards.

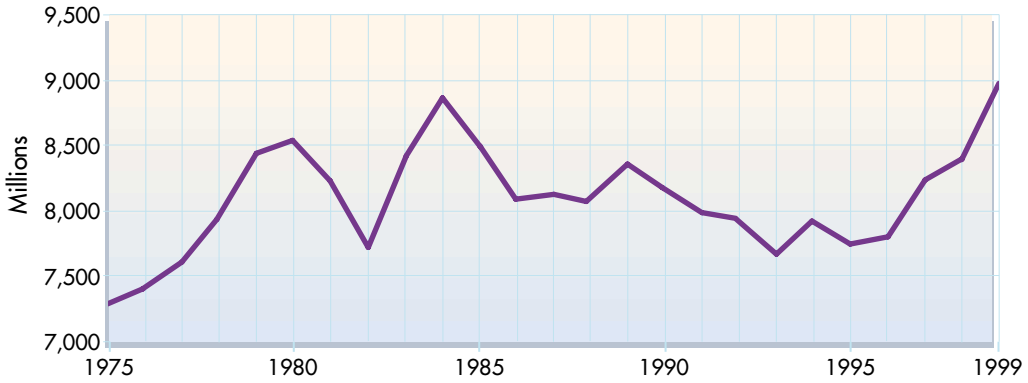
Partly as a result of these developments, the level of urban transit service provided nationwide has continued to grow into the 1990s. Ridership in 1999 reached about 9 billion trips (figure 2-12), the highest since the 1964 level of 10.4 billion.

Keys to the Future

Transit ridership has increased dramatically since the mid-1990s, and this trend is expected to continue over the next 25 years. The continuing trend toward lower densities and decentralization of economic activities presents difficulties for traditional transit services, which rely on ridership in densely populated areas. Equipment, services, and supporting policies must be designed to attract new ridership, and some are already in use. Newly developed technologies include signal pre-emption systems that in some settings have reduced onboard travel time by more than 30 percent. Advanced communications and use of global positioning systems (GPS) (see chapter 6) are reducing waiting times for transit users. These and similar technologies will make transit much more convenient in the future. Advances in bus design

Figure 2-12

Transit Ridership: 1975-99 (Annual totals)



Source: U.S. Department of Transportation, Federal Transit Administration, special tabulations, October 2000.

and construction, for example, will significantly improve bus safety, reduce operating noise, and increase efficiency. By 2025, the range of battery-powered electric vehicles, with back-up solar interchange systems, will exceed the 500-mile travel mark. Buses, charged overnight, will be ready to travel long distances.

Transit will remain a vital part of the total transportation picture by combining its best characteristics seamlessly with those of other modes. Indeed, transit ridership has been increasing and we expect that trend to continue. We must continue to invent innovative transportation routes, start new services, invent more responsive public and community transit, and create efficient, cost-effective programs.

That TEA-21 authorizes over 190 major transit projects is a recognition that communities throughout the United States view transit as a significant strategic element in their efforts to mitigate traffic congestion, improve air quality, reduce energy consumption, provide access to jobs, stimulate and sustain economic development, and strengthen community life. During the next 25 years, transit will become a competitive mode in regional multimodal transportation systems. Large urban areas will expand, and medium-sized urban areas will develop fixed guideway transit systems including commuter rail, light rail, and bus rapid transit. These systems will provide high-quality transit services that are designed to compete effectively with the automobile in a variety of travel markets. An extensive network of local and feeder bus services will support the fixed guideway transit services that, in turn, will provide "seamless" connections to the national transportation network at airports and intercity rail and bus depots. Transit providers will meet the growing need of an aging population for demand responsive transit with increasingly efficient and responsive paratransit services. ITS, such as AVL, will enable transit providers to respond in "real time" and to coordinate the extensive number of paratransit services provided in their communities.

Over the next 25 years, transit will continue to influence how urban planning and growth should occur. Coordinated transportation and land-use policies have impacted the shape of development. An interconnected network of high-speed intercity rail and magnetic levitation systems, and local commuter, rapid, and light-rail systems can form the backbone for a new pattern of development. These systems would serve to link livable rural, suburban, and urban communities. At each node, relatively dense clusters of housing and employments sites, connected with well laid out pedestrian linkages, would become the new standard of development. Such a pattern would provide increased choices and produce more efficient use of land and other resources.

By 2025, this approach to development will work because it will benefit the economy, the environment, social equity, and personal quality of life, all at the same time. Access to a broad

mix of housing types, jobs, commercial areas, parks, and civic uses is within a short distance of transit stops. Services such as health care, education, and job training are readily available near transit. Street layout and building design maximize the ease of use and pleasure of movement for pedestrians, bicyclists, and persons with disabilities. Transit serves new communities in new centers, in-fill development, and redevelopment along transit corridors within existing neighborhoods. The new transit-oriented development expands transportation choices and broadens the range of housing types and costs for all Americans. Recent evidence suggests that areas that adopt policies designed to enhance transit access produce significant savings in automobile user costs.

By 2025, our nation's transit system will continue to meet and surpass communities' mobility needs as transit ridership doubles from its current level. As a nation, we would have fully embraced the fact that mobility options beyond the automobile enhance our collective quality of living and keep us competitive in the world economy.

Passenger Railroads

The Rail Passenger Service Act of 1970 established The National Railroad Passenger Corporation (popularly known as Amtrak) on May 1, 1971, following nearly a century and a half of intercity passenger operations by private freight railroads. At least since the end of World War II, the economic viability of rail passenger service had been declining. The advent of relatively inexpensive air travel in long-distance markets and the widespread availability of the private automobile for shorter trips generated new travel patterns and drew passengers away from the railroads. Other contributing factors included increasing costs and a declining share of mail traffic.

Since its founding, Amtrak rebuilt rail equipment and benefited from significant public investment in track and stations, particularly in the Northeast Corridor. Even more important has been a shift in prevailing attitudes, both in the nation and within Amtrak itself. The 1977 *Trends and Choices* report [USDOT] termed Amtrak as experimental, but after nearly 30 years, Amtrak is now a critical fixture in America's infrastructure. Figure 2-13 shows the frequency of service on various Amtrak routes in 1999; Amtrak ridership from 1975 to 1999 is shown in figure 2-14.

In 1997, President Clinton signed into law the Amtrak Reform and Accountability Act, which authorized a record $2.3 billion in payments for capital improvements to the rail system. This was the first Amtrak Reauthorization Act, made possible by timely intervention of the administration to prevent a systemwide Amtrak strike. The Act establishes the principle that Federal funds should go only toward capital subsidies to Amtrak, while operating costs should be paid from corporate revenues. Under this principle, operating subsidies will be phased out by 2003. The Act also expanded Amtrak management's flexibility, including the ability to contract out all types of work subject to labor-management negotiations; reorganized the Amtrak Board; and set up an independent commission (the Amtrak Reform Council) to monitor progress.

Following passage of the Act, the new Amtrak Board developed a strategy that emphasized high-speed rail corridor development (see Chapter 6 for a detailed discussion on high-speed rail systems), network expansion, customer service, and new profit centers. With the new strategy, Amtrak will:

- restructure service in the Northeast Corridor, with the new high-speed Acela Express trainsets and the recent completion of electrification from New Haven to Boston;
- proceed aggressively in conjunction with states outside the northeast on high-speed rail corridor development in the Pacific Northwest, California, the Midwestern Chicago Hub,

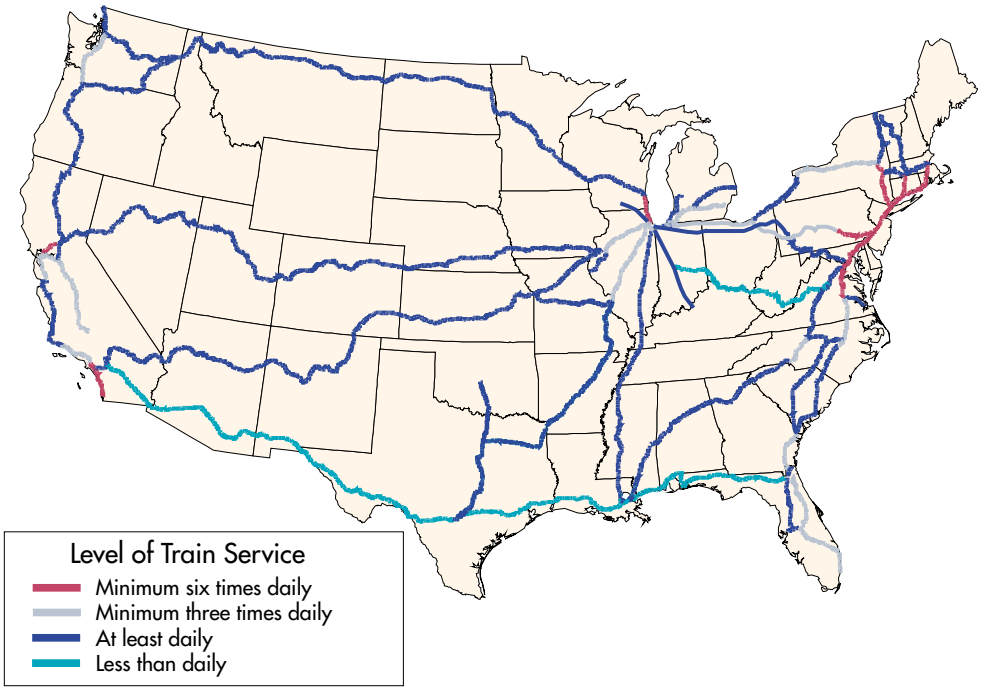
the Gulf Coast Corridor, New York's Empire Corridor, Pennsylvania's Keystone Corridor, and the Southeast Corridor linking the Northeast Corridor with the South Atlantic states;

- re-emphasize customer service by offering *service guarantees* (reimbursement coupons good for future travel) that are unprecedented in the American passenger transportation industry; and

- extend its franchise to other businesses, such as mail delivery, that traditionally formed part of its predecessor railroads' passenger operations.

Figure 2-13

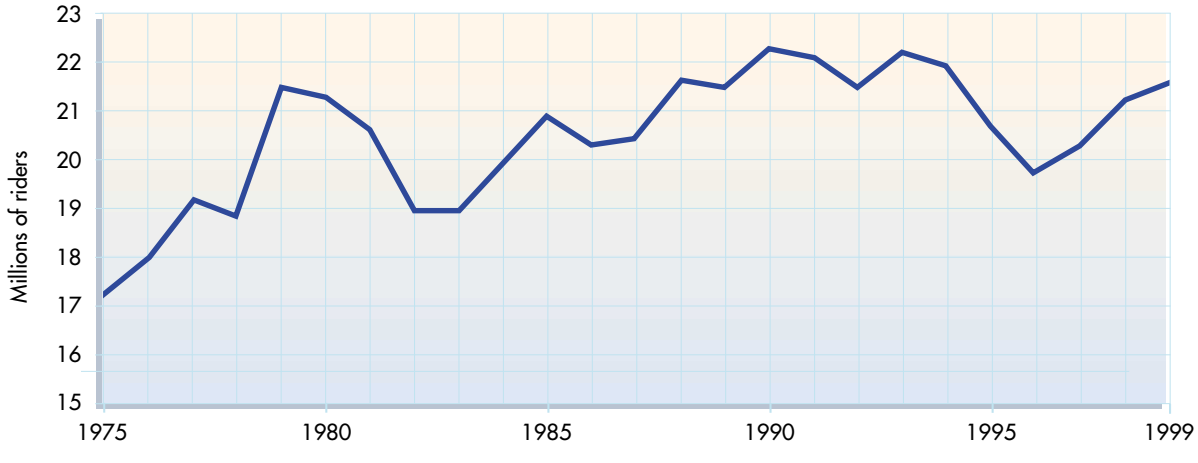
Amtrak Passenger Rail System: 2000



Source: U.S. Department of Transportation, Federal Railroad Administration, Office of Railroad Development, special tabulations, October 2000.

Figure 2-14

Amtrak Ridership: 1975-99 (Annual totals)



Source: National Railroad Passenger Corporation (Amtrak), *Annual Report* (Washington, DC: Various years).

Keys to the Future

Amtrak will face the challenge of operating quality high-speed and conventional rail systems while generating a positive operating cash flow to help support its continuing investment requirements. Amtrak may extend service to regions now unserved by passenger trains and add additional daily trains to established long-distance routes. The most significant challenge for Amtrak is eliminating its dependence on federal operating subsidies while maintaining and increasing its ability to serve the nation's passenger transportation needs.

Corridors in many regions of the United States may provide high-speed rail (HSR) service by 2025 if state and Amtrak interest continues to grow and build on success of high-speed corridors (see Chapter 6 discussion on high-speed ground transportation). By 2025, next-generation high-speed rail technologies could mature to support reliable, cost-effective systems with superb quality, including nonelectrified corridors operating at top speeds ranging from125 to150 mph, positive train control in place nationwide to improve productivity and safety, elimination of virtually all grade crossings on routes with significant traffic, and infrastructure that delivers excellent ride quality at low cost.

The public would also benefit by reductions in airport and highway congestion and air pollution through increased use of passenger rail. HSR would provide expanded transportation options to a growing ridership by connecting to commuter rail and urban transportation systems. Analogous benefits could accrue on other, less heavily traveled Amtrak routes with upgraded conventional service quality, new equipment, and enhanced reliability.

In the Northeast Corridor, high-speed rail could generate 3.5 billion passenger-miles annually by 2025, more than double the 1.7 billion in 2000. Corridors designated thus far could bring high-speed rail service to almost 75 percent of the nation's metropolitan population — over 150 million people.

Aviation

Air travel is the fastest growing mode of transportation, becoming ever more popular and frequent. The growing pervasiveness of air travel can be seen by the increasing numbers of people that have flown on a commercial jet: less than 50 percent in 1975 compared with more than 80 percent today [ATA 1998]. After a lull in the 1980s, private sector aviation is also becoming more popular. And, on the freight side, air cargo is a rapidly growing segment of the air transportation market.

In the last quarter-century, the aviation industry has undergone dramatic growth (see figure 2-15 for enplanement growth in major markets). It has experienced consolidation, while at the same time, new-entrant, low-fare competitors have emerged. Older, established airlines, such as Eastern, National, and Pan American, have disappeared, while an expanding former intrastate carrier (Southwest) has become the model for many new airlines. Globalization of our economy, the development of hub-and-spoke systems, and the emergence of low-fare carriers have also contributed to an increasing number of flights.

Passenger traffic has nearly tripled since 1975 (figure 2-16) and is expected to reach one billion enplanements within the next decade [USDOT FAA 2000a]. Air cargo (freight, express, and mail) grew much faster than the passenger sector, increasing nearly fivefold from 5 billion revenue ton-miles (RTMs) in 1975 to 25 billion in 1999 (figure 2-17). During this period, airline employment more than doubled from 297,000 employees to 728,000 employees, and labor productivity increased. The ratio of enplaned passengers per employee rose by 25 percent, and the ratio of RTMs per employee rose by 89 percent over this period. This remarkable increase in output per employee arises, in part, from the use of larger and faster aircraft, changes in flight personnel requirements, changes in work rules and practices, and adoption of various marketing strategies.

Box 2-4

Air Traffic Performance-Based Organization

On December 7, 2000, President Clinton issued an executive order to establish an Air Traffic Organization (ATO) within the Federal Aviation Administration (FAA). The purpose of this order is to enhance the FAA's mission to ensure safety, security, and efficiency of the nation's air transportation system. Establishment of the ATO will further improve the delivery of air traffic services to the American public.

A Chief Operating Officer (COO) and a five member Board of Directors, drawn from business and labor leaders to help oversee the COO and the air traffic budget, will administer the new organization.

Specifically, the ATO will:

(a) optimize use of existing management flexibilities and authorities to improve the efficiency of air traffic services and increase the capacity of the system;

(b) develop methods to accelerate air traffic control modernization and to improve aviation safety related to air traffic control;

(c) develop agreements with the Administrator of the FAA and users of the products, services, and capabilities it will provide;

(d) operate in accordance with safety performance standards developed by the FAA and rapidly respond to FAA safety and security oversight findings;

(e) consult with its customers, the traveling public, including direct users such as airlines, cargo carriers, manufacturers, airports, general aviation, and commercial space transportation providers, and focus on producing results that satisfy the FAA's external customer needs;

(f) consult with appropriate federal, state, and local public agencies, including the Department of Defense and the National Aeronautics and Space Administration, to determine the best practices for meeting the diverse needs throughout the National Airspace System;

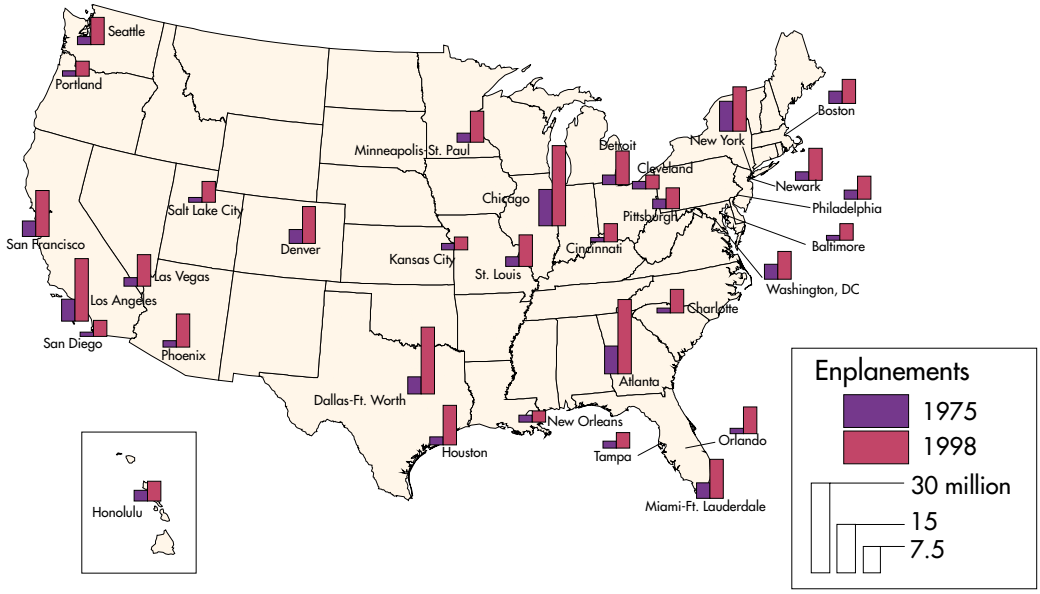
(g) establish strong incentives to managers for achieving results; and

(h) formulate and recommend to the Administrator any management, fiscal, or legislative changes necessary for the organization to achieve its performance goals.

The establishment of the semiautonomous ATO will go a long way toward improving our ability to cope with increasing congestion in the skies. It will allow more efficient management of the air traffic services and accelerate the reform of our air traffic system. Additionally, if we reform the way air traffic control service is financed, from a system financed by passenger taxes to one in which commercial users pay the costs of the services they use, we can ensure that air travel in the 21st century is the safest, most cost-effective, and most efficient in the world.

Figure 2-15

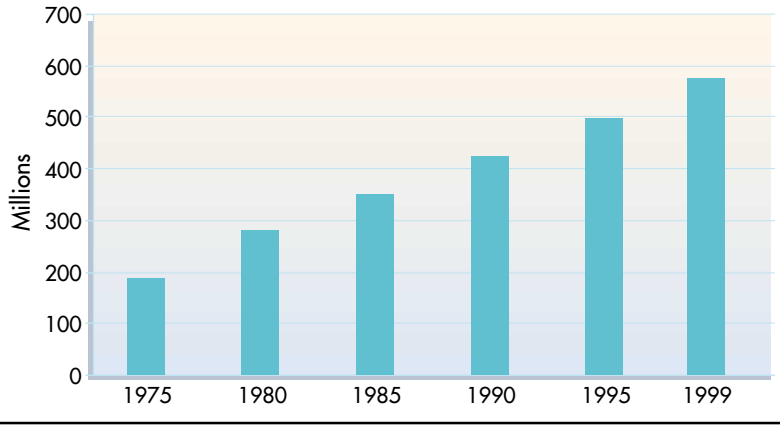
Enplanements in Major Markets: 1975 and 1998



Note: These data include those hubs that were classified as large hubs in either 1975 or 1998 or in both years. A large hub is a geographic area that enplanes 1 percent or more of national enplaned passengers. A hub may include more than one airport.
Source: U.S. Department of Transportation, Bureau of Transportation Statistics, Office of Airline Information, 1976; and *Airport Activity Statistics of Certificated Air Carriers, Summary Tables 1999* (Washington, DC: 1999).

Figure 2-16

Domestic Enplanements on U.S. Commercial Air Carriers: 1975-99

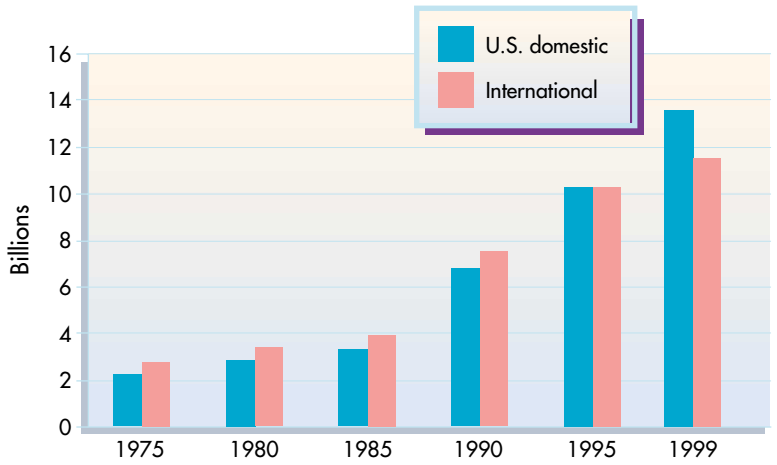


Source: U.S. Department of Transportation, Bureau of Transportation Statistics, Office of Airline Information (Washington, DC: Various years).

The increases in passenger and cargo traffic, however, have come with an associated price. More traffic has increased congestion in the aviation system, especially at the hubs. A study by the USDOT Inspector General's Office [USDOT OIG 2000] shows that delays are growing nationwide. The study tracked 2,036 domestic routes and found that gate-to-gate times had increased on 77 percent of them between 1988 and 1998.

Figure 2-17

U.S. Domestic and International Freight Revenue Ton-Miles: 1975-99



Source: U.S. Department of Transportation, Bureau of Transportation Statistics, Office of Airline Information (Washington, DC: Various years).

Through collaborative leadership, the FAA is working with the aviation industry to address aviation congestion issues. In March 2000, USDOT initiated a collaborative spring/summer effort in cooperation with the airlines industry to reduce delays due to severe weather conditions. In August 2000, Secretary Slater convened, for the first time, airline industry stakeholders to discuss the current challenges facing the industry and promote innovative strategies to reduce congestion at the nation's airports. As a result of this meeting, three task forces were set up to: address airlines service quality performance, identify "best practices" in improving the accuracy and timeliness of flight information provided to air travelers, and expedite the investment in infrastructure. Similar collaborative efforts are continuing at the USDOT to reduce congestion and the resulting delays and to provide a better experience to the air travelers.

Box 2-5

AIR-21

The Aviation Investment and Reform Act for the 21st Century (AIR-21) was enacted by Congress and signed by the President in the spring of 2000. The act substantially increases funds for airport development both through the Airport Improvement Program and by enabling an increase in the Passenger Facility Charge. AIR-21 provides needed airport infrastructure grants that can result in competitive access for new entrant carriers across the nation. The Act also funds the continued redevelopment of the air traffic control infrastructure, providing the most significant changes in technology and procedures in 50 years.

Air-21 continues implementing the goal of modernizing and stabilizing FAA's critical air traffic services for the nation. It shifts FAA's air traffic management from a centralized command and control hierarchy to a more demand responsive and collaborative model managed by the expanded Aviation Management Advisory Council.

AIR-21 also contains increased authorizations to provide for USDOT enforcement of consumer protection, such as those prohibiting deceptive advertising and those providing denied-boarding protection.

Source: Public Law 106-181 (Apr. 5, 2000), Aviation Investment and Reform Act for the 21st Century (AIR-21), 2000. Information available at www.nw.faa.gov/airports/preservations/FieldAIR=21/index.htm/ as of Aug. 23, 2000.

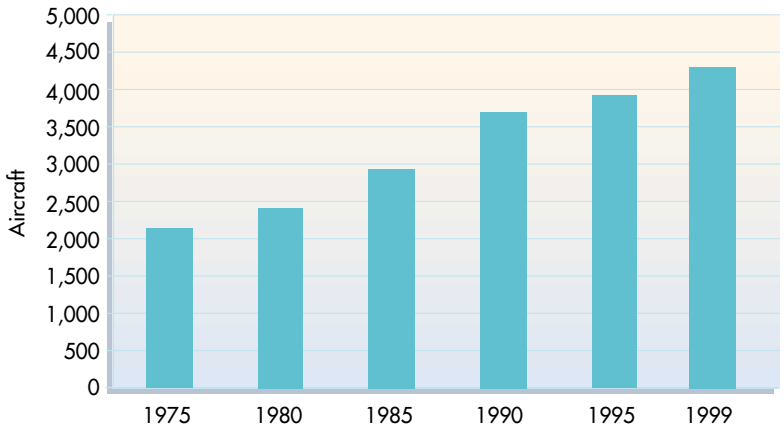
Large Commercial Air Carriers: To accommodate growth in domestic demand, commercial air carriers have expanded capacity. From 1975 through 1999, the number of large passenger jet aircraft in the U.S. fleet more than doubled, increasing from 2,135 in 1975 to 4,312 in 1999 (figure 2-18). Domestic available seat miles increased from 244 billion to 677 billion, up more than 177 percent.

As passenger miles increased during the last two decades, the average domestic load factor increased from 53 percent in 1975 to almost 70 percent in 1999 (figure 2-19). Air carriers also improved their operating profits by better managing full-fare and discounted seats. Due to increased load factors, airlines restructured and reduced unit costs, increasing efficiency and productivity.

U.S. domestic Revenue Passenger Miles (RPM) grew from 129 billion in 1975 to 473 billion in 1999—an average increase of 5.6 percent per year. From 1975 through 1999, commercial air carrier domestic fares, adjusted for inflation, declined 38.6 percent [USDOT BTS OAI n.d.(a)].

Figure 2-18

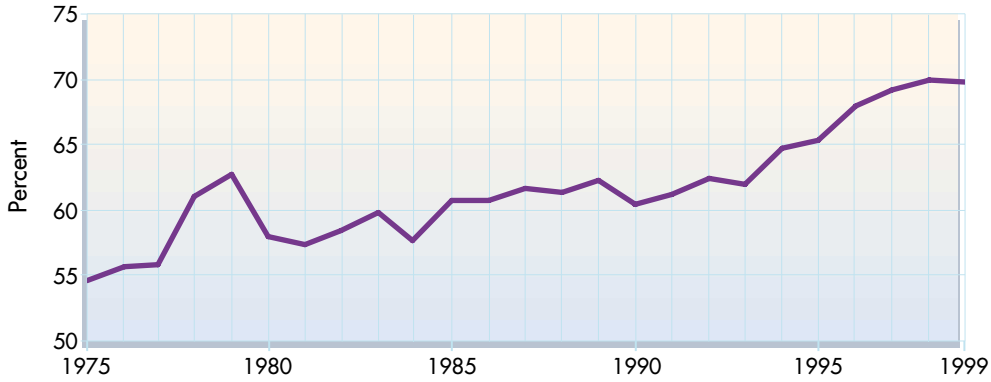
Large Passenger Jet Aircraft in the U.S. Fleet: 1975-99



Source: U.S. Department of Transportation, Bureau of Transportation Statistics, Office of Airline Information (Washington, DC: Various years).

Figure 2-19

Domestic Load Factor for Large Commercial Air Carriers: 1975-99



Source: U.S. Department of Transportation, Bureau of Transportation Statistics, Office of Airline Information (Washington, DC: Various years).

Box 2-6

Higher Profits for U.S. Airlines

During the 20 years since deregulation, U.S. air carriers have earned more than $38 billion in operating profits and more than $6.5 billion in net profit. The years 1994 to 1998 were the most prosperous, with more than $30.9 billion in operating profits and $14.6 billion in net profits.

From 1979 through 1983—the first five years of deregulation—the U.S. air carrier industry incurred operating losses of more than $1 billion. Losses resulted from operating in an increasingly unregulated market, petroleum price increases in 1979 and 1980, and the economic recessions of 1980 and 1982.

From 1984 through 1988, losses in the air-carrier industry began to reverse. During this time, operating profits were more than $10.3 billion, and net profits were more than $3.2 billion. Profits came from a stronger U.S. economy and slower growth in operating expenses. Slower growth in operating expense, in turn, resulted from increasing productivity, wage concessions from airline employees, and declining fuel costs.

The industry experienced difficult times again during the 1989 to 1993 period, when operating losses exceeded $2.1 billion, and net losses were almost $10.5 billion. In part, problems stemmed from uncertainties generated by the Gulf War and the threat of terrorism. Other reasons included a downturn in both U.S. and world economies, as well as rising jet fuel prices. In 1993, President Clinton signed legislation creating the National Commission to Ensure a Strong, Competitive Airline Industry to study problems facing the aviation industry. Former Virginia Governor Gerald L. Baliles chaired the commission, whose recommendations stimulated the return of the commercial aviation industry to profitability in 1994 and subsequent strong growth. The strong growth resulted from several factors, including a growing U.S. economy, an increase in worldwide traffic demand, declining fuel prices, and high load factors.

The historically high load factors being experienced by the industry today (70 percent domestic market and 74 percent international market) are attributed to the use of a wide variety of yield management strategies. Today's technology allows carriers to maintain large databases that include information on flights, bookings, and the impacts of seat-selling discounts. This information allows airlines to predict demand and manage capacity. Yield management systems are largely responsible for U.S. carriers increasing load factors by almost 17 percentage points system-wide since 1975 [USDOT BTS OAI n.d.(b)].

Airlines are changing their marketing strategies to take advantage of new opportunities offered by selling tickets via the Internet, because this allows them to cut costs and deal directly with travelers. The major air carriers encourage this method of distributing tickets by offering frequent flier mileage bonuses and discount fares for purchasing tickets over the Internet.

Box 2-7

Air System Financing

Airport and Airway Trust Fund dollars have accounted for approximately 64 percent of all FAA funding since the Trust Fund's creation in 1970. The Trust Fund percentage of the total has been increasing, from 40 percent in the 1970s to 54 percent in the 1980s and 71 percent in the 1990s. There were frequent statutory changes from the 1970s through the 1990s that redefined the eligible uses of aviation trust fund monies, particularly the mix of operations versus capital spending from the trust fund.

Regionals/Commuters: The Airline Deregulation Act of 1978 created major opportunities for the group of airlines originally called "commuter" airlines and now called "regional" airlines. In 1975, the industry was operating on the fringes of the service areas of the large commercial air carriers. The typical commuter airline was a fixed-base operator that provided

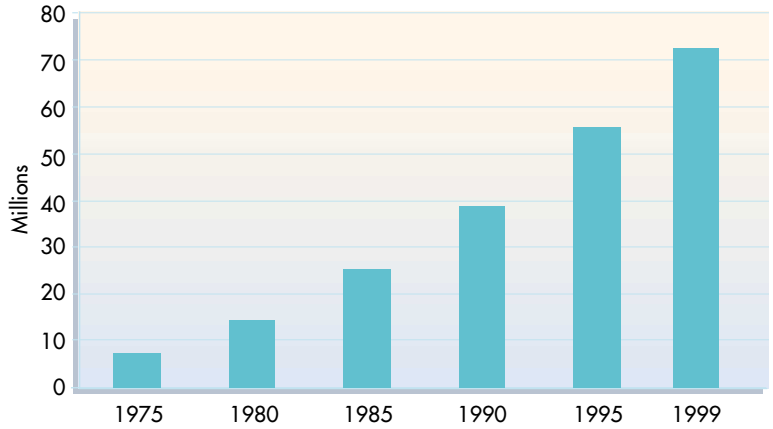
scheduled air service to small communities using small aircraft that seated fewer than 30 passengers.

Between 1975 and 1985, regional/commuter enplanements more than tripled, increasing from 7 million to 25 million; revenue passenger miles increased almost five-fold, from 760 million to almost 3.8 billion [USDOT BTS OAI n.d.(c)]. The regional/commuter airlines became increasingly important sources for connecting traffic to major carriers. These connections led to the next significant trend to evolve from deregulation—the development of "code-sharing agreements" between the major and regional air carriers (see Chapter 4, box 4-3).

In 1986, large air carriers began purchasing their regional partners, and as of 1999, the major airlines owned 15 regionals, totally, or in part. The close relationship between the regionals and the large air carriers continues to shape the industry today. In 1999, the regional/commuter airline industry enplaned 72 million passengers, the result of a 10.1 percent average annual increase since 1975 (figure 2-20). Revenue passenger miles totaled 18.8 billion in 1999, representing an average annual increase of 14.3 percent [USDOT BTS OAI n.d.(c)].

Figure 2-20

Regional/Commuter Airline Revenue Enplanements: 1975-99



Source: U.S. Department of Transportation, Bureau of Transportation Statistics, Office of Airline Information (Washington, DC: Various years).

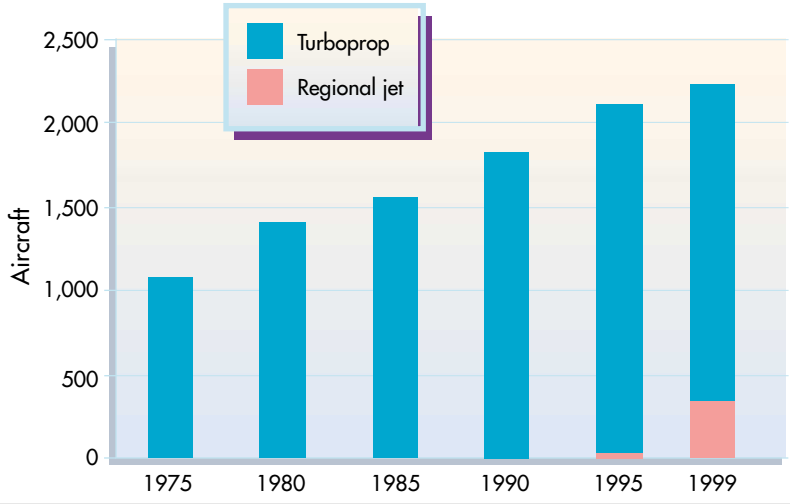
The evolution within the regional/commuter industry is also underscored by changes in the range of markets served and in the fleet composition. As passenger traffic continued to grow, larger regional aircraft with greater range were introduced into the regional fleets.

These new aircraft, designed to meet the mission and market demand of the regional industry, are probably the most visible sign of changes within the industry and reflect its growth and reach. During the 1980s and early 1990s, larger turboprop aircraft were prevalent. From the mid-1990s to today, new regional jets, first introduced in 1993, became common. Figure 2-21 shows the growth of the regional/commuter aircraft fleet. Between 1975 and 1999, the industry's average passenger trip length increased from 105 to 260 miles (figure 2-22). In the future, new regional jets will help shape and support regional/commuter airline growth.

The regional airline industry has become an integral part of today's national air transportation system. However, this growth has led to increased consolidation. The number of airlines has declined significantly, while the average size of the carriers has increased dramatically. In 1975, there were 170 reporting carriers, which grew to a high of 245 in 1980. Since then, the number of regional/commuter airlines has declined steadily to only 93 carriers in 1999. In 1975, the 170 regional carriers averaged just over 42,300 enplanements per carrier, but in 1999, the 93 carriers averaged more than 778,000 passenger enplanements per carrier.

Figure 2-21

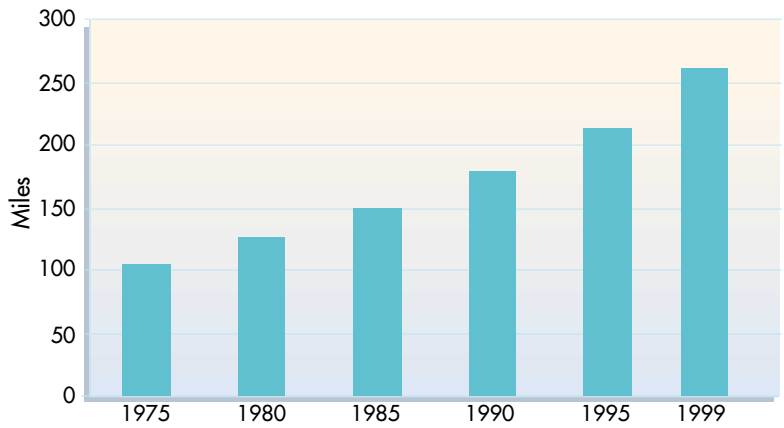
Regional/Commuter Passenger Aircraft Fleet: 1975-99



Source: U.S. Department of Transportation, Bureau of Transportation Statistics, Office of Airline Information (Washington, DC: Various years).

Figure 2-22

Average Trip Length on Regional/Commuter Carriers: 1975-99



Source: U.S. Department of Transportation, Federal Aviation Administration, *Working Paper on Aerospace Capacity and Demand* (Washington, DC: 2000).

Today's regional airlines are more aptly characterized as large, professionally managed businesses, operating state-of-the-art aircraft and poised for continued growth [USDOT BTS OAI n.d.(c)].

Air Cargo: The demand for air cargo transportation has grown as economic activity has increased. Growth in air cargo activity has historically been strongly related to growth in the Gross Domestic Product (GDP). By providing faster ways for businesses to deliver high-value goods to customers, air cargo transportation has become a major factor in economic growth.

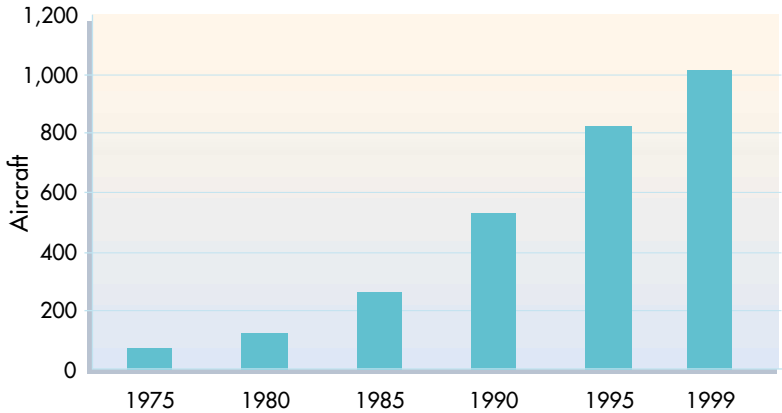
Air cargo has grown even faster than airline passenger traffic. The 6.1 percent annual growth in domestic freight RTMs from 1975 to 1999 was greater than the percent growth in RPMs (figure 2-17). Industry growth was primarily attributable to the growth of all-cargo carriers, which accounted for more than two-thirds of domestic freight RTMs in 1999 [USDOT BTS OAI n.d.(b)]. Federal Express and United Parcel Service are the two largest domestic all-cargo carriers. Both of these carriers are integrated carriers providing door-to-door service using intermodal systems.

Freight also is moved in the cargo-holds of passenger aircraft and in dedicated all-cargo aircraft. To meet the increased demand for air-freight traffic, the fleet of dedicated all-cargo jet aircraft increased from 70 aircraft in 1975 to 1,013 aircraft in 1999 (figure 2-23). The most significant change in the fleet during the 1980s was the extensive use of Boeing 727 freighters due to the rapid growth of integrated express carriers.

General Aviation: General aviation—the use of business and corporate aircraft, personal aircraft, and air taxis—is in a period of strong growth, with more planes flying, more new aircraft being delivered, and more pilots earning their licenses. Even greater increases are projected for the next quarter century [USDOT FAA OAPP 2000].

Figure 2-23

U.S. All-Cargo Fleet: 1975-99



Source: U.S. Department of Transportation, Federal Aviation Administration, *Working Paper on Aerospace Capacity and Demand* (Washington, DC: 2000).

After a decline in the early 1990s, general aviation activity increased 4.3 percent per year between 1996 and 1999 [USDOT FAA 2000b]. The turnaround in general aviation is attributed to the U.S. economic expansion during the Clinton-Gore administration, in 1993, President Clinton's first trip to Everett, Washington, focused on bringing the aviation leaders together to foster growth in the industry after a serious downturn in prior year profits. The General Aviation Manufacturers Association (GAMA) estimates that more than 7,000 U.S. companies operate business aircraft. Favorable economic conditions have improved the market demand for business jets, especially for larger aircraft with ranges of more than 6,000 miles. In addition, fractional ownership, aircraft shared among several individuals or businesses, has contributed to the demand for business jets [GAMA 2000].

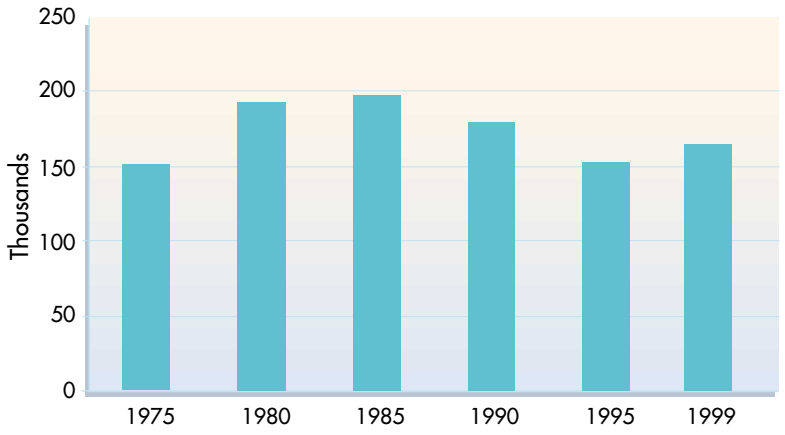
Fixed-wing piston aircraft continue to dominate general aviation, currently accounting for more than 79 percent of the active fleet. Currently, the size of the fixed-wing piston fleet is similar to that of 1975, but the industry is rebounding from a decline in the early 1990s (figure 2-24). The size of the fixed-wing turbine fleet has more than tripled since 1975, totaling 12,700 in 1999 (figure 2-25).

GAMA has estimated that more than 25,000 manufacturing jobs have been created in the general aviation industry as a result of GARA. GARA limits the number of years for which manufacturers are liable for general aviation aircraft. The general aviation industry had been in a dramatic decline in the 1980s—U.S. companies sold more than 17,000 piston aircraft in 1979 and had dropped to less than 700 in 1999—citing the costs of liability insurance for older aircraft as a major cause in this decline. GAMA also reports increases in general aviation exports, new general aviation products due to increases in research and development by its members, and an increase in the number of student pilots [GAMA 1999].

Commercial Space Transportation: Commercial space transportation did not exist in 1975. However, since the mid-1990s, commercial space-launch activities have grown as U.S. com–mercial companies responded to the increased global demand for commercial satellite-launch

Figure 2-24

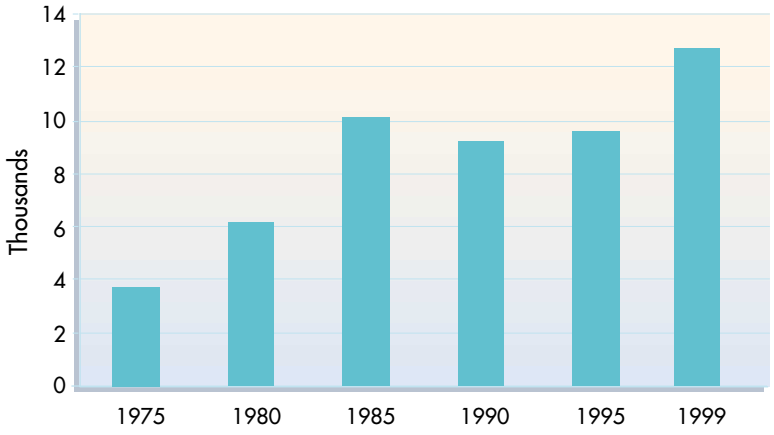
Fixed-Wing Piston Aircraft: 1975-99



Source: U.S. Department of Transportation, Bureau of Transportation Statisticas, Office of Airline Information (Washington, DC: Various years).

Figure 2-25

Fixed-Wing Turbine Aircraft: 1975-99



Source: U.S. Department of Transportation, Federal Aviation Administration, *Working Paper on Aerospace Capacity and Demand* (Washington, DC: 2000).

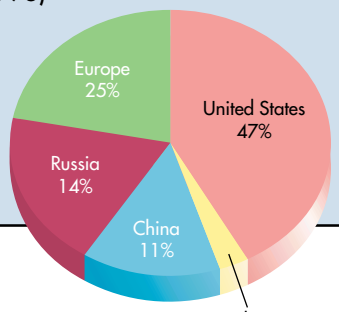
services. The first U.S. commercial launch took place in 1989. In 1999, there were 17 FAA-licensed commercial space launches, for a total of 130 launches through July 2000; of these, 115 have been successful [Smith 2000].

The growth in the commercial satellite-launch industry was prompted by the destruction of the space shuttle *Challenger* and the subsequent decision to prohibit commercial payloads on the shuttles. This left the United States with severely limited launch capability. Other nations entered this business, setting the stage for the highly competitive and growing world market in space launch. The United States went from zero commercial launch capability in 1988 to $1 billion in launch revenues in 1998. In 1998, U.S.-based launch providers achieved a 47 percent share of the international commercial launch market (figure 2-26).

Before 1990, most responsibilities for the U.S. space-launch bases and ranges belonged to the government, particularly the Air Force. Today, commercial launch operators and spaceports are responsible for operating and maintaining the satellite and launch vehicle

Figure 2-26

Commercial Satellite Launches by Country: 1998 (Percent of market share in 1998)



Source: U.S. Department of Transportation, Federal Aviation Administration, *Commerical Space Transportation: 1998 Year in Review* (Washington, DC: 1999).

facilities and launch complexes that they lease or license from the Air Force. The FAA has issued a space-launch site operator's license for commercial spaceports at Vandenberg Air Force Base, California; Spaceport Florida at Cape Canaveral Air Station, Florida; the Virginia Space Flight Center at Wallops Island, Virginia; and Spaceport Alaska at Kodiak Island, Alaska. The FAA has also licensed launches from the Sea Launch venture, which had its first successful launch in 1999 from a sea-based platform near the equator in the Pacific Ocean.

These spaceports focus on small to medium rockets used primarily to launch low Earth orbit (LEO) communications satellites. LEO satellites orbit at altitudes ranging from 100 to 22,300 miles—the distance required for geostationary orbit. Demand for this type of launch is increasing, and a number of firms are competing to establish constellations of LEO satellites providing global mobile communications systems. All of the numerous proposed LEO systems use varying numbers of evenly spaced satellites circling the globe, so that one is always within reach of Earth-bound communications devices. They essentially allow anyone, anywhere on Earth, to communicate with anyone anywhere else, using a special handheld telephone (Big LEO) or other, nonvoice communications device, such as a pager or alphanumeric messaging receiver (Little LEO).

Keys to the Future

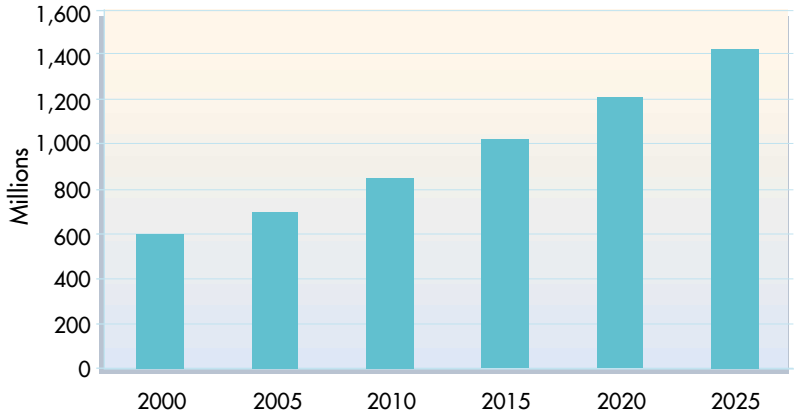
FAA estimates show that commercial airlines will continue to benefit from moderate to strong economic growth. The forecasts also expect a combination of technological improvements and continued cost containment efforts to benefit the overall financial performance of both U.S. and foreign flag carriers.

In addition, the operation of a fleet consisting entirely of Stage 3 aircraft (aircraft with reduced noise level), which are more fuel-efficient, will result in further cost savings and increased industry productivity. These productivity improvements should strengthen overall industry financial performance, reduce air-carrier marginal costs, and benefit the traveling public with lower airline fares. Further, we are working with our international partners to develop a Stage 4 aircraft and schedule it for future deployment.

Domestic enplanements are predicted to increase 3.4 percent per year from 2000 to 2025 (figure 2-27). To accommodate the growth in traffic over this period, the large air carrier jet passenger fleet is expected to increase 3.6 percent per year, expanding from 4,355 aircraft in 2000 to an estimated 9,941 aircraft in 2025 (figure 2-28). With congestion already apparent at airports and in the skies, capacity issues must be addressed to accommodate future growth.

Figure 2-27

Domestic Enplanements on U.S. Commercial Air Carriers: Projected – 2000-25

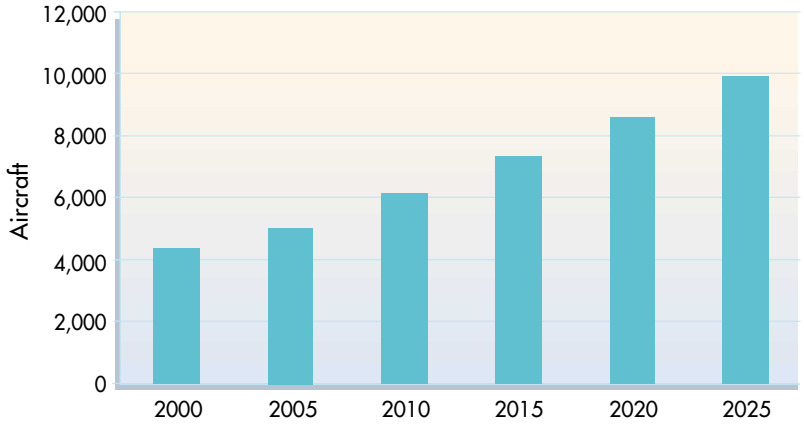


Source: U.S. Department of Transportation, Federal Aviation Administration, *Working Paper on Aerospace Capacity and Demand* (Washington, DC: 2000).

The FAA, in cooperation with NASA, is carrying out research and development to modernize the National Air Space (NAS) system and improve its safety, security, efficiency, and environmental compatibility. Together, they have set a vision and identified goals to be achieved by 2025 (see box 1-4). Daniel S. Goldin, NASA administrator, foresees a future in which new technological developments will allow our aviation system to meet growth in air travel by 2025 (see box 6-13).

Figure 2-28

U.S. Commercial Air Carriers' Passenger Jet Aircraft: Projected – 2000-25

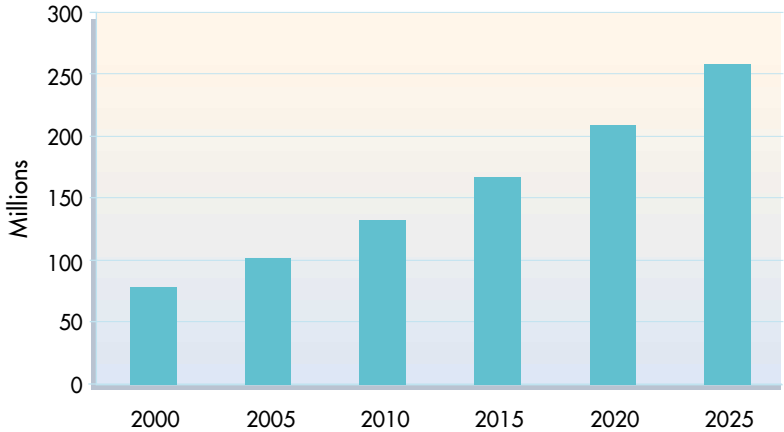


Source: U.S. Department of Transportation, Federal Aviation Administration, *Working Paper on Aerospace Capacity and Demand* (Washington, DC: 2000).

Over the next 25 years, the regional/commuter airline industry is expected to continue outpacing the growth of large commercial air carriers. By 2025, the regional airline industry is estimated to enplane more than 244 million passengers annually, at a 4.7 percent average annual growth rate (figure 2-29). By 2025, the regional/commuter industry's share of total domestic enplanements is predicted to be well over 15 percent, compared to 11.2 percent in 1999.

Figure 2-29

Regional/Commuter Air Carrier Enplanements: Projected – 2000-25



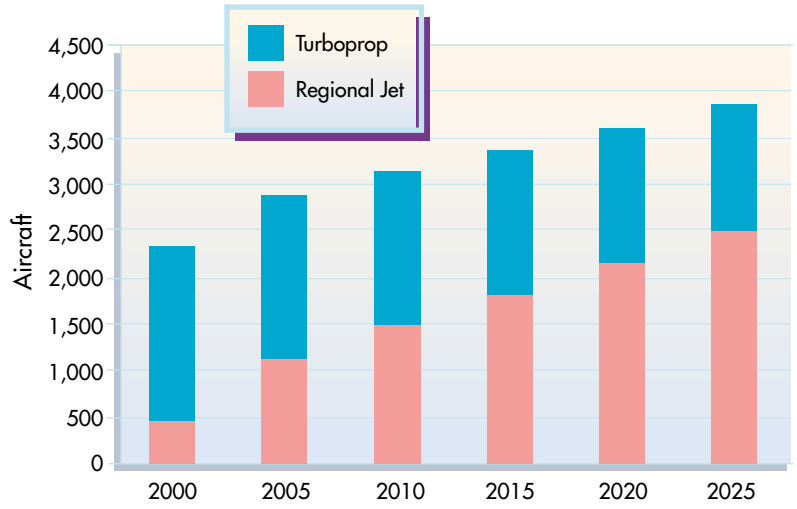
Source: U.S. Department of Transportation, Federal Aviation Administration, *Working Paper on Aerospace Capacity and Demand* (Washington, DC: 2000).

More than any other factor, the change in the regional aircraft fleet will define the industry's future. While deregulation was the driving force behind the industry's growth from 1978 through the mid-1990s, the popularity and recent rapid introduction of regional jets and the market applications they dictate will shape the industry's future trends.

During the next 25 years, the regional/commuter fleet is expected to increase from 2,237 aircraft in 1999 to 3,870 in 2025, an increase of 73 percent (figure 2-30). More significantly, regional jets are expected to become the mainstays of the fleet midway through this 25-year period. By 2025, regional jets may account for nearly 65 percent of the fleet, compared to only

Figure 2-30

Regional/Commuter Commercial Passenger Aircraft Fleet: Projected – 2000-25



Source: U.S. Department of Transportation, Federal Aviation Administration, *Working Paper on Aerospace Capacity and Demand* (Washington, DC: 2000).

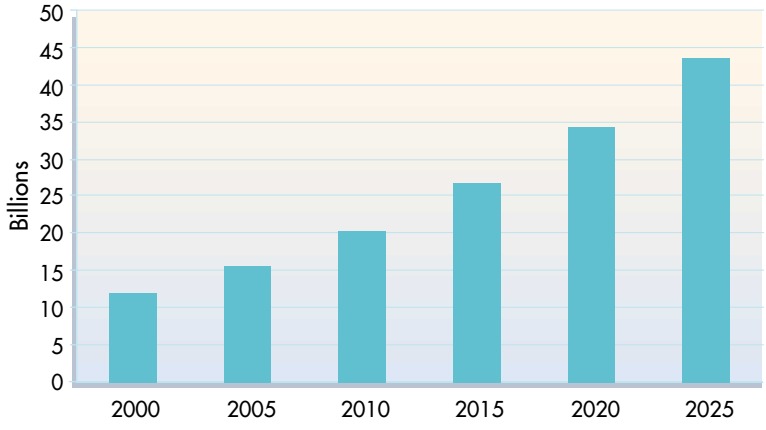
15 percent in 1999. The number of turboprops may actually decline by an estimated 28 percent. The projected large growth in the number of regional jets raises questions about the ability of the air traffic system to handle the demand placed on it. The expected decline in the number of small turboprops may also mean that some small communities will lose all scheduled air service.

Air cargo growth is expected to mirror trends in economic growth. The ever-increasing trend toward globalization could stimulate demand for both domestic and international markets.

Domestic air cargo RTMs are forecasted to increase nearly four times between 1999 and 2025, with an annual increase of more than 5 percent to reach 43.7 billion RTMs in 2025 (figure 2-31). The all-cargo carriers are expected to accommodate nearly all of the additional growth. To accommodate the demand for air cargo growth, the fleet of all-cargo jet aircraft is forecasted to more than double between 1999 and 2025. The fleet is projected to increase from 1,046 aircraft in 2000 to 2,646 aircraft in 2025, an annual increase of 3.8 percent. An increasing percentage of the future cargo fleet will be composed of passenger aircraft conversions.

Figure 2-31

U.S. Domestic Air Freight Revenue Ton Miles: Projected – 2000-25



Source: U.S. Department of Transportation, Federal Aviation Administration, *Working Paper on Aerospace Capacity and Demand* (Washington, DC: 2000).

In 1999, narrow-body aircraft and wide-body aircraft accounted for 67.7 and 32.3 percent of the all-cargo jet fleet, respectively. The number of wide-body aircraft is forecasted to grow much faster than that of narrow-body aircraft and account for more than half the fleet by 2011. A key issue will be the capacity of existing infrastructure to handle the increasing air cargo movement efficiently.

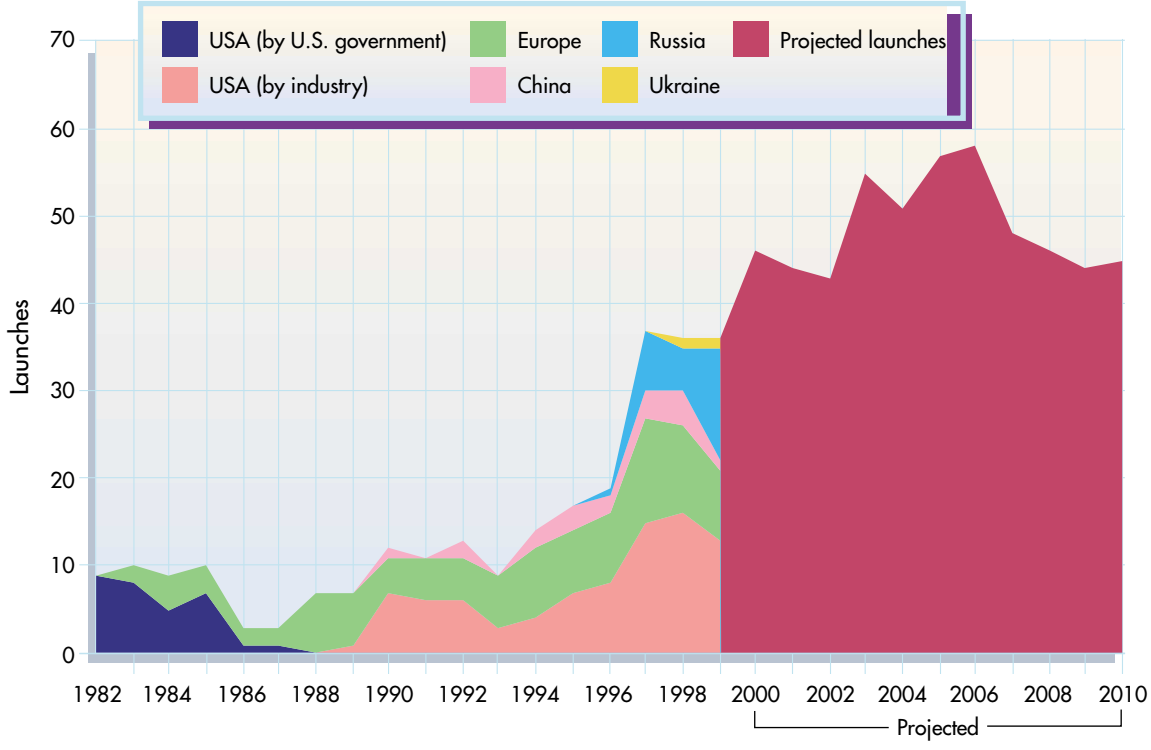
The general aviation fleet is expected to continue its growth over the next 25 years. The largest absolute increase is projected to be in the number of active fixed-wing piston aircraft—increasing from 165.2 thousand to 190.7 thousand.

The fixed-wing turbine aircraft fleet is expected to almost double over the next 25 years, reaching 24,900 in 2025. Rotocraft are forecast to increase by more than 36 percent over the same period, from about 7,700 in the year 2000 to approximately 10,500 in 2025. Increases in the numbers of experimental aircraft and other aircraft (gliders, lighter-than-air, balloons) are also expected.

The FAA and the Commercial Space Transportation Advisory Committee (COMSTAC) project an annual average of 51 commercial space launches worldwide through 2010, a 40 percent increase from the 36 commercial launches conducted worldwide in 1999 (figure 2-32). It is forecasted that, on average, the following type and number of launches will occur each year through 2010: 40 launches of medium-to-heavy launch vehicles (25 to geosynchronous orbit and 15 to LEO) and 11 launches of small launch vehicles to LEO.

Figure 2-32

Commercial Launches by Country: 1982-2010



Source: U.S. Department of Transportation, Federal Aviation Administration, *Working Paper on Aerospace Capacity and Demand* (Washington, DC: 2000).

Government and industry representatives have worked together to consider alternatives for the several possible paths along which U.S. space-launch capability may develop over the coming decades, as well as the appropriate near-term steps. It is likely that the FAA and the Air Force will develop a shared relationship for determining commercial-launch safety requirements.

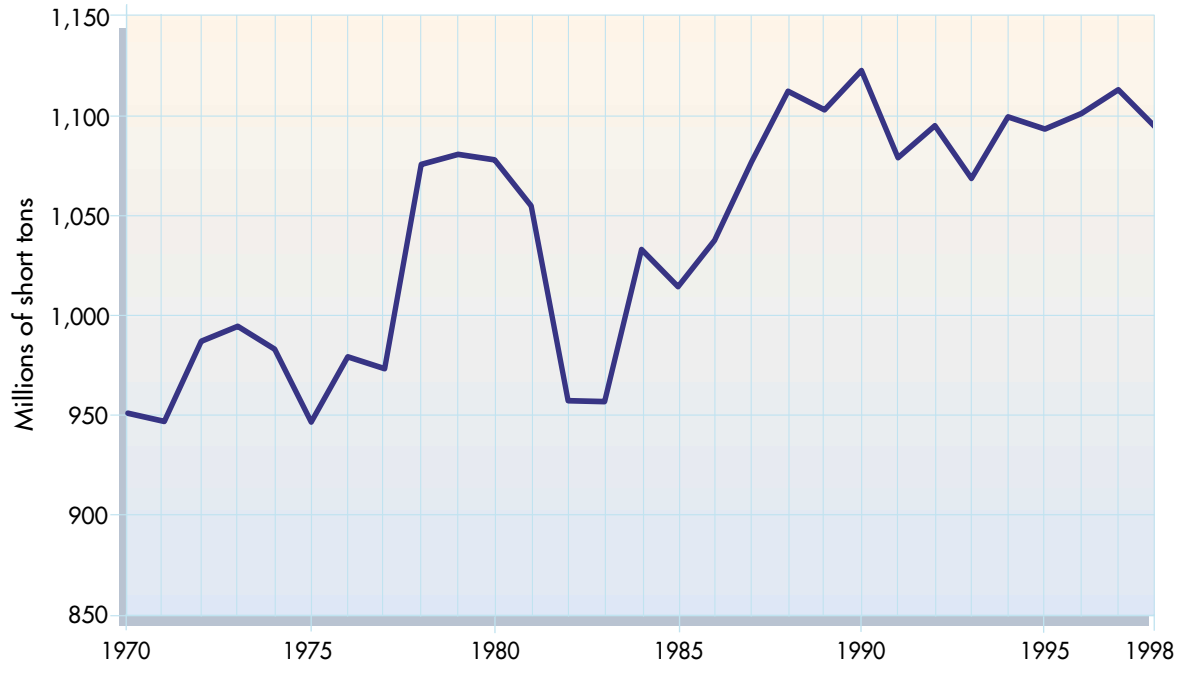
Maritime Shipping

The U.S. maritime transportation system consists of waterways, ports and their intermodal connections, vessels, vehicles, and system users. During the past 25 years, pressure to lower prices and improve service, as well as the growing application of new technologies have transformed the maritime shipping industry. Maritime shipping has generally been intermodal; other forms of transportation are needed to haul cargo to and from ports. The container revolution has made the connections to rail and truck significantly more efficient. The increased use of containers during the past 25 years has far outpaced that of other forms of maritime trade (dry bulk, tanker, and general cargo).

In 1975, the U.S. domestic shipping industry was growing rapidly due to an increase in crude oil trade and was projected to grow even faster. But by 1998, it had grown by only 16 percent in tonnage (figure 2-33) due to increased dependence on pipelines to transport crude oil. On the other hand, waterborne foreign trade has grown 65 percent by weight (short-tons) since 1975 (figure 2-34). The projected growth in domestic shipping led to improvement of the nation's inland waterway system, including the Tennessee-Tombigbee Waterway, new locks and dams on the Mississippi River, and the St. Lawrence Seaway (figure 2-35), and other improvements. Figure 2-36 shows the overall U.S. inland waterway system.

Figure 2-33

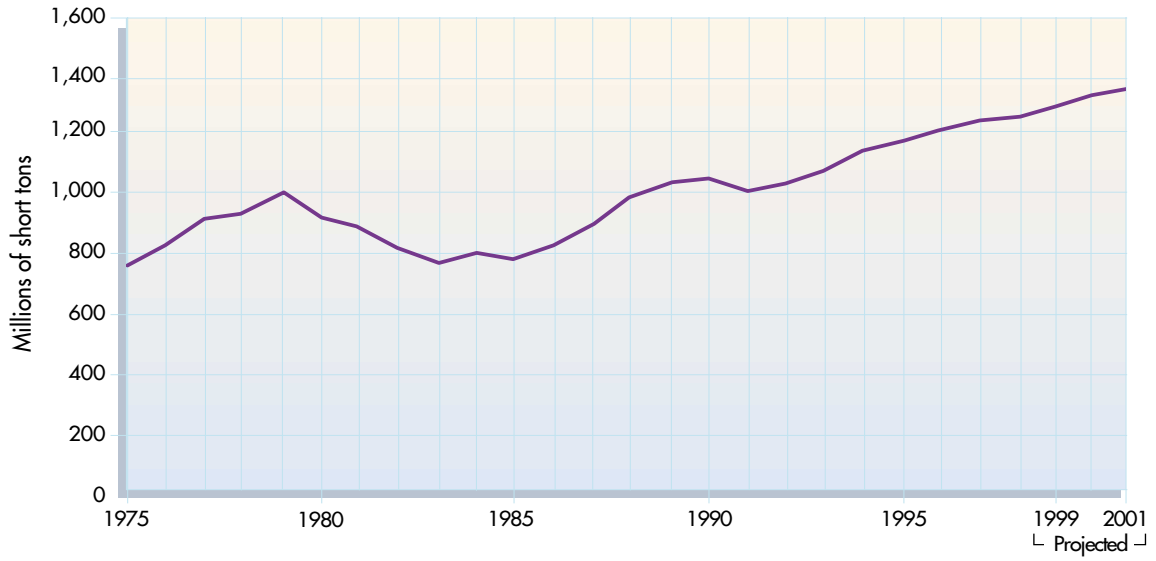
U.S. Waterborne Domestic Trade: 1970-98 (Annual totals)



Source: U.S. Army Corps of Engineers, Water Resources Support Center, *Waterborne Commerce of the United States 1998, Part 5, National Summaries* (Fort Belvoir, VA: 2000).

Figure 2-34

U.S. Waterborne Foreign Trade: 1975-2001 (Annual totals)



Source: U.S. Army Corps of Engineers, Water Resources Support Center, *Waterborne Commerce of the United States 1998, Part 5, National Summaries* (Fort Belvoir, VA: 2000); DRI/McGraw-Hill, *World Seatrade Service* (New York, NY: McGraw-Hill Companies: 1999).

Figure 2-35

The St. Lawrence Seaway

Source: Environmental Systems Research Institute, Inc., *ESRI Data & Maps* (CDROM) (Redlands, CA: 1999).

Figure 2-36

U.S. Inland Waterway System: 1999

Source: U.S. Department of Transportation, Bureau of Transportation Statistics, National Transportation Atlas Database (Washington, DC: 2000).

Based on the Maritime Administration's analysis of a survey conducted by the American Association of Port Authorities, the U.S. port industry has invested approximately $15 billion since 1973 on improvements in its port facilities and infrastructure. Between 1979 and 1989, new construction was 72.6 percent of total U.S. public port industry capital expenditures. In the 1970s and 1980s, the North Atlantic ports ranked highest in the level of total industry investments [USDOT MARAD 1997]. Port industry investments between 1994 and 1998 account for about 42 percent of total U.S. port industry investments since 1973. Types of investment include new construction and modernization/rehabilitation. For 1998, new construction accounted for 73.3 percent of total expenditures. Also for 1998, the Pacific Coast ports accounted for nearly 50 percent of total industry investment.

The world's general-cargo trades were revolutionized by U.S. shipbuilding innovations in advanced containerships and roll-on/roll-off vessels. At the end of 1975, the United States held 25 percent of the world's fleet of general cargo ships, which carried 30 percent of the tonnage. Tables 2-1 and 2-2 show the status of the U.S. oceangoing merchant fleet in 1975 and 1999, respectively. Growth in the number of full containerships began to change the shipping world, as shipping lines and ports developed container facilities to compete with noncontainer general-cargo vessels.

In 1975, New York led all U.S. ports in tonnage. The Port of Long Beach was the tenth-ranked port by tonnage (table 2-3); primary trade for California ports was tanker imports of petroleum and petroleum products. The tanker trade, hurt by the worldwide oil crisis of previous years, was beginning to recover in 1976 due to increased petroleum imports. Overall, the liner trade was strongest at that time and was expected to continue to increase, while the cruise industry carried only a limited number of passengers.

Table 2-1

U.S. Oceangoing Merchant Marine: as of June 30, 1975
(Self-propelled vessel ≧ 1,000 gross tons)

	Privately owned		Government-owned		Total	
	Ships	Deadweight tons (000)	Ships	Deadweight Tons (000)	Ships	Deadweight tons (000)
Combination passenger/cargo	7	59	57	354	64	413
Freighters	162	2,190	215	2,176	377	4,366
Bulk carriers	19	543	0	0	19	543
Intermodal	148	2,807	4	47	152	2,854
Total U.S. flag	583	14,610	308	2,999	891	17,609

Source: U.S. Department of Commerce, Maritime Administration, June 1976.

Table 2-2

U.S.-Flag Oceangoing Self-Propelled Merchant Vessels of 1,000 Gross Tons and Over as of Apr. 1, 1999

Active fleet	Ships	Deadweight tons (000)
Tanker	123	7,914
Dry bulk	14	579
Containership	82	2,905
Roll-on/roll-off	27	552
Cruise/passenger	4	37
Other	28	689
Total	**278**	**12,676**

Source: U.S. Department of Transportation, Maritime Administration, U.S. Merchant Marine Data Sheet, as of Apr. 1, 1999.

Table 2-3

U.S. Oceanborne Foreign Trade Top 10 Ports (1975)
(Thousands of tons)

U.S. Port	Imports	Exports	Total
New York	50,153	5,524	55,677
Baton Rouge	39,861	8,563	48,424
Houston	23,520	13,360	36,880
Norfolk	5,818	27,694	33,512
Philadelphia	29,055	4,370	33,425
New Orleans	13,814	19,170	32,984
Baltimore	17,546	13,309	30,855
Corpus Christi	17,125	3,844	24,969
Beaumont	15,441	3,476	18,917
Long Beach	13,348	4,975	18,323

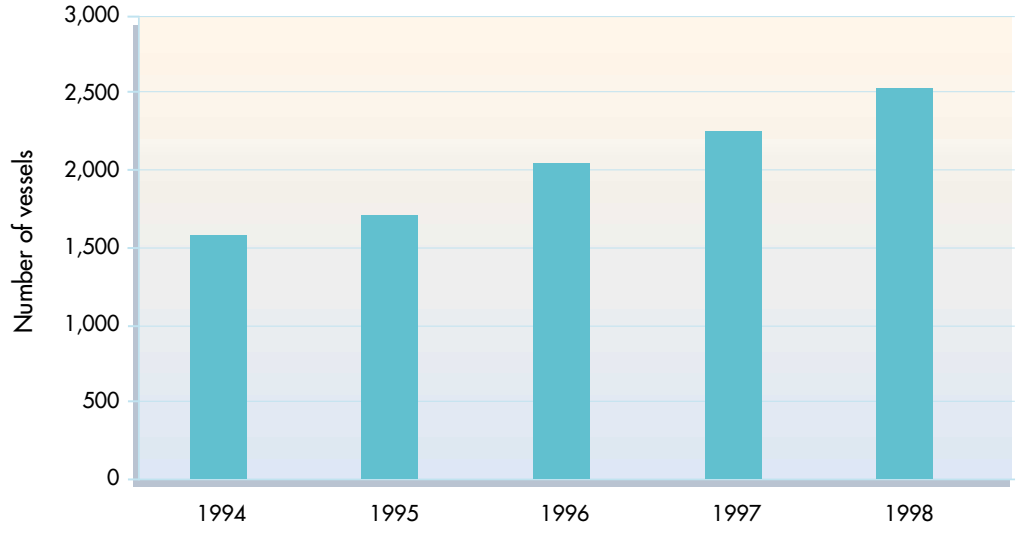
Source: U.S. Department of Commerce, Maritime Administration, *United States Oceanborne Foreign Trade Routes* (Washington, DC: 1978).

The maritime industry has changed more dramatically in the past 30 years than in any other period in history. Where shipping could once be divided into tankers, bulk carriers, and dry-cargo ships, there are now many more specialized ship designs. Container ships, which first appeared in the 1960s, are now commonplace, although their proportion of the world shipping fleet is still relatively small. Between 1994 and 1998, the number of container vessels grew by 57 percent (figure 2-37). Roll-on/roll-off ships dominate short sea routes in many parts of the world.

World containerized trade moves almost doubled between 1991 and 1999 (figure 2-38), and U.S. ports on both coasts have responded to their increased activity. By 1987, New York was the top U.S. port in the container trade, followed by Long Beach, and the top 15 U.S. container ports accounted for 89 percent of the total activity in the United States. Figure 2-39 shows the location of the top 25 container ports and the volume of containers handled in 1987 and 1999 (see also tables 2-4 and 2-5).

Figure 2-37

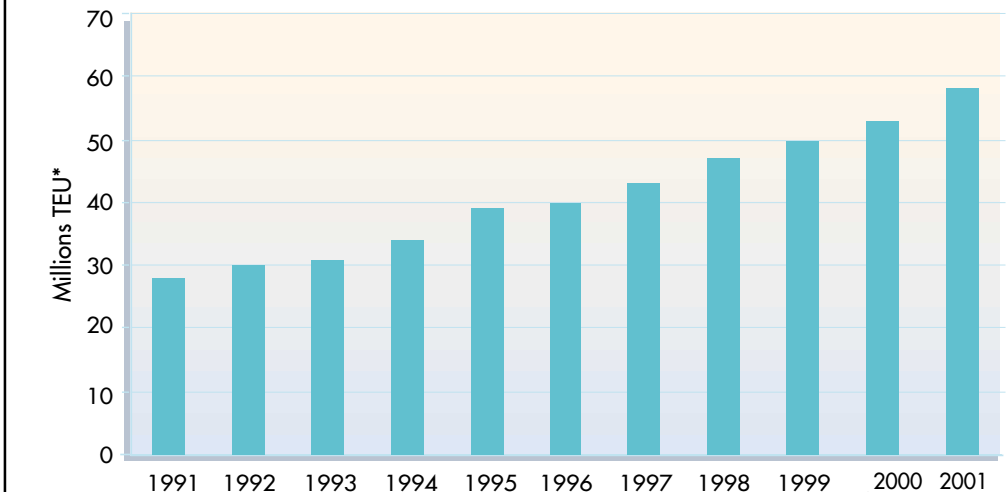
World Container Vessel Fleet: 1994-98



Source: Lloyd's Maritime Information Service, vessel inventory datafile, various years, available at www.lmis.com/f-sdat.htm, as of October 2000.

Figure 2-38

World Containerized Trade Moves: 1991-2001

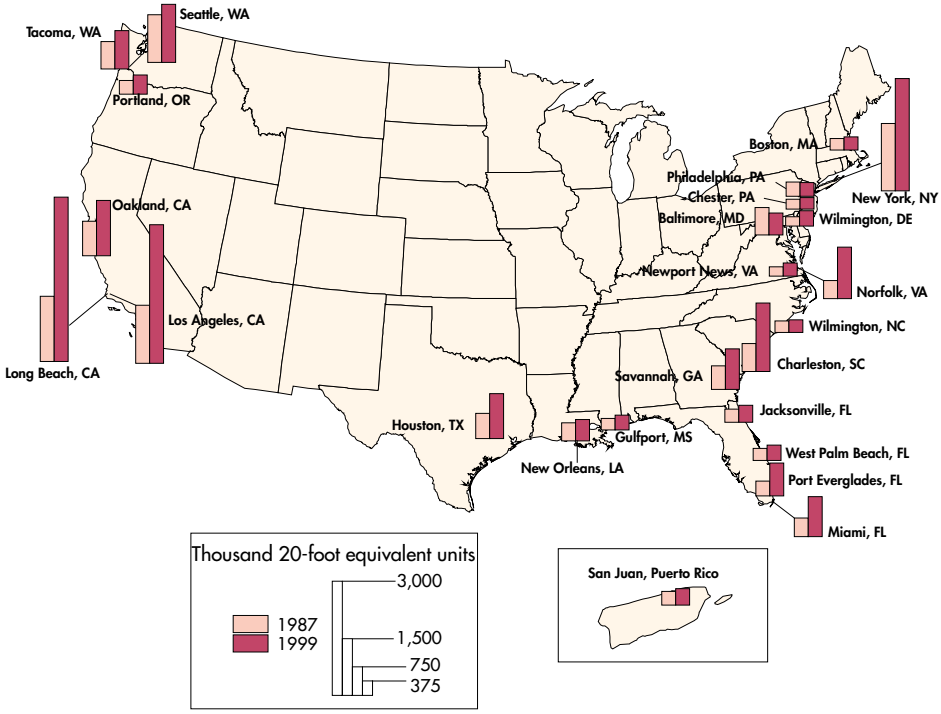


*TEU = Twenty-foot Equivalent Unit.

Source: K.C. Sjetnan, 1999, *Cargo Systems, The Future of the Container Shipping Industry* (London: IIR Publications, Ltd.).

Figure 2-39

Top 25 U.S. Container Ports: 1987 and 1999



Source: *Journal of Commerce*, data from Port Import/Export Reporting Service (PIERS), 2000.

Table 2-4

U.S. Waterborne Container Trade – Top 10 Ports
(Thousands of metric tons)

U.S. Port	1997
Long Beach, CA	20,142
Los Angeles, CA	15,231
New York, NY	15,003
Charleston, SC	8,996
Seattle, WA	7,980
Oakland, CA	7,289
Norfolk, VA	7,433
Houston, TX	6,207
Miami, FL	4,982
Savannah, GA	4,895

Source: *Journal of Commerce*, data from PIERS, 1998.

Table 2-5

Top 20 Container Ports: Throughput 1998

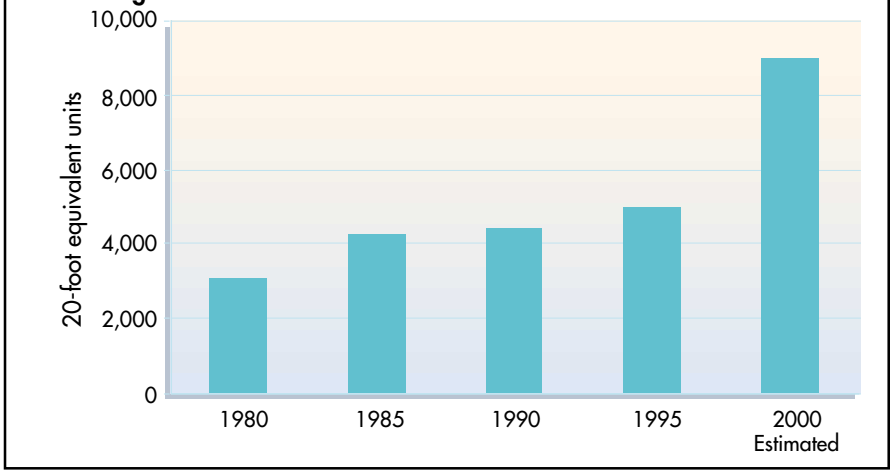
	Port	Container throughput
1	Singapore	15,100,000
2	Hong Kong	14,582,000
3	Kaohsiung	6,271,053
4	Rotterdam	6,010,000
5	Pusan	5,752,955
6	Long Beach	4,100,000
7	Hamburg	3,546,940
8	Los Angeles	3,378,218
9	Antwerp	3,265,000
10	Shanghai	3,000,000
11	Dubai	2,804,104
12	Tokyo	2,495,000
13	New York/New Jersey	2,465,993
14	Felixstowe	2,461,823
(Tie) 15	Gioia Tauro	2,100,000
	Kobe	2,100,000
17	Yokohoma	2,091,240
18	San Juan	1,990,272
19	Manila	1,856,372
20	Algreciras	1,825,614

Source: K.C. Sjetnan, 1999, *Cargo Systems, The Future of the Container Shipping Industry* (London: IIR Publications, Ltd.).

Ships, on average, are getting bigger. Today's container vessels have 50 percent or more cargo capacity than those of 1975. Figure 2-40 shows the increasing size of container vessels between 1980 and 2000. The first mega-container ship, with a capacity of 8,000 20-foot equivalent units (TEUs) (e.g., a TEU is the length of a container divided by 20), was developed by a German consortium in 1997.

Figure 2-40

The Largest Container Vessels: 1980-2000



Source: K.C. Sjetnan, 1999, *Cargo Systems, The Future of the Container Shipping Industry* (London: IIR Publications, Ltd.).

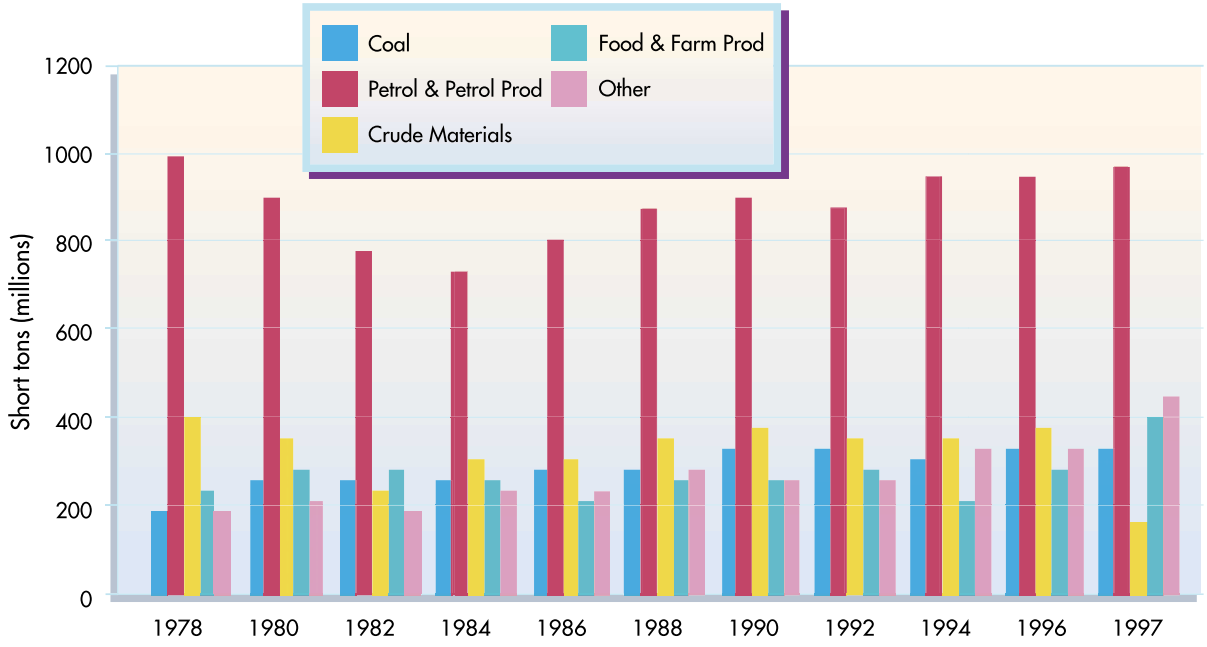
The container revolution has emphasized the serious infrastructure problems facing the U.S. ports and waterways. The newer, larger ships of the 1970s required deepening of waterways and ports, but a political stalemate over funding in the early 1980s stopped these improvements. The Water Resources Development Act (WRDA) of 1986 provided the impetus for many U.S. ports to deepen channels to enable them to handle large bulkships. The WRDA fundamentally altered the financial basis of the maintenance of American harbors by creating a new Harbor Maintenance Trust Fund. Rather than relying on general appropriations to pay for port deepening and maintenance dredging, funds were collected by a tax—the Harbor Maintenance Tax—on cargo value. The WRDA also, for the first time, required local project sponsors (state and local agencies) to pay a share of costs. Since then, the U.S. Supreme Court has ruled that the Harbor Maintenance Tax is an unconstitutional tax when applied to exports. In 1999, the Clinton Administration proposed a fee based on registered tonnage of a ship, adjusted for the ship's cargo and passenger capacity.

U.S. domestic waterborne trade, consisting primarily of bulk commodities moving on U.S. inland, Great Lakes, and coastal waters, suffered during the oil shortages of the mid-1970s, the inflation and financial crises of the early 1980s, and the Mississippi River flood in 1993. In the 1990s, however, it has shown moderate increases. The top three commodity groups in the U.S. domestic waterborne trade over the past 10 years have been petroleum and petroleum products, crude materials, and coal. In the mid-1980s, food and farm products fell to number four, behind coal. Figure 2-41 shows the top commodities shipped by waterborne commerce in the United States.

The North American cruise passenger trade has shown steady growth for almost two decades, increasing an average of 7.6 percent per year from 1980 to 1997. The cruise industry, which is primarily foreign-owned, is using new ships and amenities to attract the vacation dollars of American tourists [DRI/McGraw-Hill 2000].

Figure 2-41

U.S. Total Waterborne Commerce: 1978-97



Source: U.S. Army Corps of Engineers, *Waterborne Commerce of the United States 1998, Part 5, National Summaries* (Fort Belvoir, VA: 2000).

Keys to the Future

As foreign trade continues to grow, U.S. ports and their intermodal connections face four significant problems:

- changing business practices;
- ports must seek new financial resources for expansion and deepening projects to accommodate the new generation of bigger, faster cargo ships;
- environmental concerns that have impacted port expansion must be addressed; and
- maintenance projects and landside connections must be improved.

The U.S. Supreme Court's ruling, in March 1998, that the Harbor Maintenance Tax is an unconstitutional tax on exports has placed funding for port expansion, deepening, and maintenance in jeopardy. Proposals have been made to adopt other tax structures or return to the use of general appropriations for port projects. In any case, a strategic investment in the marine transportation system is required to meet future global demands.

The U.S. Coast Guard will continue to seek innovative means of managing our nation's waterways to ensure the safe and efficient movement of people and goods. These efforts must proactively manage the multiple competing uses of the nation's waterways and ensure that increased usage of the waterways for both commerce and recreation does not degrade the safety, efficiency, and environmental integrity of the waterways. The outcome of these efforts will ensure the continued reliability and efficiency of waterway transportation needed to accommodate the increased demands the marine transportation system will face in light of projected increases in maritime trade.

Spurred by an expected three-fold increase in container traffic by 2025, the maritime sector will likely follow the lead of the aviation industry and establish a "hub and spoke" system of marine transportation. One or two megaports (hubs) on each coast will receive and send line-haul traffic, which would be lightered up or down the coasts on container barges. Establishment of hub and spoke systems will likely be further prompted by the inability of most U.S. ports to handle future generations of container megaships while the likelihood of constructing new, large ports is very low.

Many areas of the country, such as New York, Boston, and Oakland, have experienced lengthy permit application processes for dredging ports because of environmental concerns related to disposal of dredged material in the ocean.

Ports, in cooperation with other modes of transportation, must also look to innovative means of moving cargo to and from landside destinations. The total volume of domestic and inter–national marine trade is expected to triple over the next 25 years. Major U.S. ports face prob–lems of landside congestion and scarcity of land to accommodate these increasing cargo flows.

In southern California, the Alameda Corridor is under construction to move huge volumes of cargo to and from the Ports of Los Angeles and Long Beach. The 20-mile, $2.4 billion corridor, expected to be open in 2002, connects the ports by rail to an intermodal transfer site. Accompanying truck lanes are also part of the project. In northern New Jersey, officials are considering construction of a new portway for trucks to move cargo to and from Port Newark and Port Elizabeth. Other ports are also considering projects to provide better on-dock or near-dock rail access and to improve the flow of truck traffic into and out of ports. Over some medium-distance destinations, it may be possible to promote barge operations to ease landslide congestion.

The use of new information technologies is likely to increase the global nature of shipping as buyers and sellers use the Internet to execute transactions worldwide as they solicit product bids, obtain freight rates, and charter ships online.

By 2025, port operations will be fully automated and information technologies, beyond today's tracking and tagging, will specify where and when a container should be loaded and what time it should arrive at the port, eliminating storage needs while promoting seamless transfer of containers across transportation modes. However, these technological improve-ments will not obviate the need for people. Low-cost global positioning system (GPS) receiv-ers can also improve operations. For example, very accurate positioning readings can help ship pilots find navigable channels, greatly reducing the need to dredge.

All of these technologies will help meet the higher expectations businesses will demand of transportation services: reliability, timeliness, efficiency, low cost, and damage minimization.

Deregulation

Since the late 1970s, both the nature and importance of regulation have changed as the federal government has undertaken some major deregulation initiatives. In the mid-1970s, nearly all interstate transportation was subject to government economic regulation. By 1999, the decisionmaking process covering entry, exit, pricing, and quality of service has been relinquished by the federal government and turned over to the carriers and to market forces. Regulatory emphasis has shifted from economic controls, such as rate and entry controls, industry concentration, labor relations, and antitrust immunity to safety, environmental, and capability concerns.

Significant deregulation legislation includes the Motor Carrier Act of 1980 for Interstate trucking; deregulation of intrastate trucking in 1994; the Revitalization and Regulatory Reform Act of 1976 and the Staggers Rail Act of 1980 for railroads; the Bus Regulatory Reform Act of 1982 for buses; the Airline Deregulation Act of 1978 for airlines; and the 1984 Shipping Act for ocean carriers.

Generally, the goal of deregulation has been to remove or reduce government-imposed constraints on the power of the market forces to determine industry economics. The desire to relax these constraints often grew out of recognition by the transportation enterprise that the conditions that stimulated the original regulatory actions no longer applied. In most cases, deregulation has been successful in creating conditions more conducive to industry success, but in some circumstances has led to decreased service options in rural areas.

This section on deregulation focuses on the far-reaching changes that resulted from the economic deregulation of the motor carrier (trucking and bus), freight railroad, aviation, and maritime industries, and looks at the impacts on transportation activity.

Motor Carriers

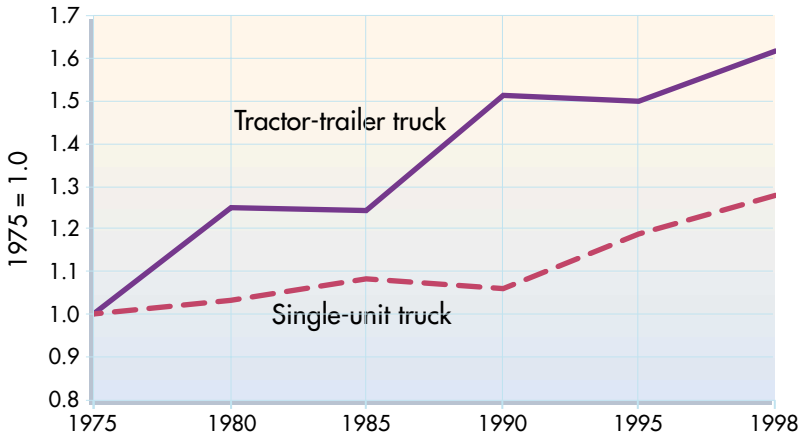
The motor carrier industry comprises truck and bus companies. In 1975, the motor carrier industry was regulated by the Interstate Commerce Commission (ICC). The ICC controlled routes of service and rates through its rate bureaus. Start-up companies were required to prove that their plan to provide new service was in the public's best interest. Only a limited number of truck and bus companies were authorized to provide service—18,000 truck companies in 1975 compared with nearly 500,000 today [USDOT FMCSA 2000]. Responding to concerns about the economic inefficiency of the trucking industry, the ICC loosened the entry standards in the late 1970s. The Motor Carrier Act of 1980 further eased barriers to entry.

Trucking companies were given authority to set rates independently, and most antitrust immunity for collective rate-making was eliminated. As a result, existing carriers expanded into new services with new routes and new, smaller carriers entered the business operations. In the years immediately following 1980, the use of private carriers ("in-house" trucking fleets) declined as companies chose to take advantage of lower rates and improved service by the for-hire carriers. During the 1980s, the number of motor carriers and commercial trucks increased (see figure 2-42 for growth in the number of commercial trucks). Today, there are nearly 500,000 trucking companies providing service, most of them with six or fewer trucks (table 2-6).

Deregulation also led to fragmentation of industry services and concentration of market power. Under the regulatory regime,

Figure 2-42

Index of Number of Commercial Trucks: 1975-98



Source: U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics* (Washington, DC: various years).

Table 2-6

Active Interstate Carriers by Fleet Size: 2000

Fleet size (number of power units)	Number of Carriers			
	Hazardous material	Passenger carriers	All others	Total
One	9,083	5,927	204,269	219,279
2 to 6	17,249	4,535	139,021	160,805
7 to 20	9,028	1,470	32,058	42,556
21 to 100	5,194	832	9,799	15,825
101 to 5,000	1,644	147	1,417	3,208
Over 5,000	17	1	8	26
Unspecified	1,410	2,360	80,587	84,357
Total	**43,625**	**15,272**	**467,159**	**526,056**

Note: Data include intrastate hazardous materials carriers.
Source: U.S. Department of Transportation, Federal Motor Carrier Safety Administration, *Motor Carrier Management Information System Report LS50B901* (Washington, DC: March 2000).

many carriers offered both truckload (TL) and less than truckload (LTL) services. But, under deregulation, carriers began to specialize in either LTL or TL with the vast majority of carriers entering the TL segment. Very few carriers entered the LTL sector, and the largest LTL carriers have increased their control of that segment even more significantly. Deregulation also increased the use of owner operators, drivers who own their vehicle and typically rent themselves out to larger carriers.

Increased competition has improved industry efficiency as carriers face constant pressure to reduce operating costs or risk losing market share to competitors. Since labor represents a relatively significant portion of total operating costs in the industry, drivers' wages have not been immune to this pressure. Since 1975, drivers' real earnings, adjusted for inflation, have declined. Coinciding with, and partially responsible for, this wage stagnation has been a decrease in the number of for-hire drivers represented by labor unions, with representation falling from a high of 60 percent in 1973 to below 25 percent by 1995.

Less than half of total trucking activity on the nation's highway network, measured by both ton-miles and value of shipments, occurs within state boundaries [USDOT BTS 1997b]. In 1994, 41 states still maintained some form of economic regulation over intrastate trucking. With interstate trucking deregulated, intrastate rates were 40 percent higher than rates for interstate moves of the same distance. The federal government removed intrastate regulations in 1994.

Bus companies, too, were given freedom to set rates and determine routes as a result of deregulation in 1982. Economic deregulation spurred strategic reorganization of the bus industry, created conditions for improved services, and, in certain cases, resulted in diminished services. Greyhound and Trailways joined forces in 1987 to provide a larger network of intercity bus service. In addition, new, smaller regional carriers have started providing service to specialized niche markets. These carriers not only serve geographic markets, but also sectors of the population, such as senior citizens, metropolitan commuters, vacation travelers, or luxury travelers. About 4,000 private motorcoach companies operate in the United States, offering charters, tours, regular route service, and other bus services [ABA n.d.].

Following deregulation and with increasing competition from airlines and automobiles, bus companies eliminated many unprofitable routes and stops, particularly in rural areas. In 1982, more than 11,000 locations were served nationwide, down from more than 16,000 in the early 1970s. Today, the number of locations served has fallen to just about 5,000, with much of

the curtailed service in rural areas. The Federal Transit Act provides support for the intercity bus needs of rural residents.

Keys to the Future

Today, regulatory concerns focus on safety in both the truck and bus industry. The new USDOT Federal Motor Carrier Safety Administration (FMCSA) was created in 1999 by the Motor Carrier Safety Improvement Act to step up enforcement efforts and target more resources to ensure safety compliance. New efforts using information technology are underway to improve safety data collection, its timeliness, and dissemination to enforcement officials. The FMCSA was the first regulatory agency to move many of its regulatory process to the Internet in order to fully maximize public participation in its processes. This could have a major impact and help USDOT ensure safer movement of goods and passengers on our highways as we look to the future. For a discussion of safety trends, see Chapter 3.

Today, the motor carrier industry remains an integral part of the increasingly intermodal supply chains. By 2025, large logistics providers who today manage these supply chains will have their own truck fleets largely through acquisitions and mergers of existing motor carriers. These companies will also own air- and sea-based fleets to provide door-to-door service across the world. The increase in LTL shipments for just-in-time deliveries will provide opportunities for using smaller containers, compared to the 20- to 40-foot containers used today.

By 2025, the United States, Canada, and Mexico will have seamless cross-border movements truly creating a seamless North America. This will provide tremendous economic benefits to the entire region.

Freight Railroads

In 1975, the nation's railroads—once the cornerstone of the transportation system—were foundering under ICC regulations that dated back to the 19th century. They did not have enough capital to invest in new track and equipment and operated with unsafe and deteriorating equipment. In 1976, more than 47,000 route-miles—about 25 percent of the nation's total—were operated at reduced speeds because of dangerous conditions [AAR 2000a].

The Railroad Revitalization and Regulatory Reform Act of 1976 partially deregulated rail rates and expedited merger processing. That year, government-sponsored Conrail replaced seven bankrupt northeastern rail lines. In 1980, the Staggers Act gave railroads the freedom to set rates, subject to maximum rate regulation, and were allowed to abandon service on unprofitable rail lines.

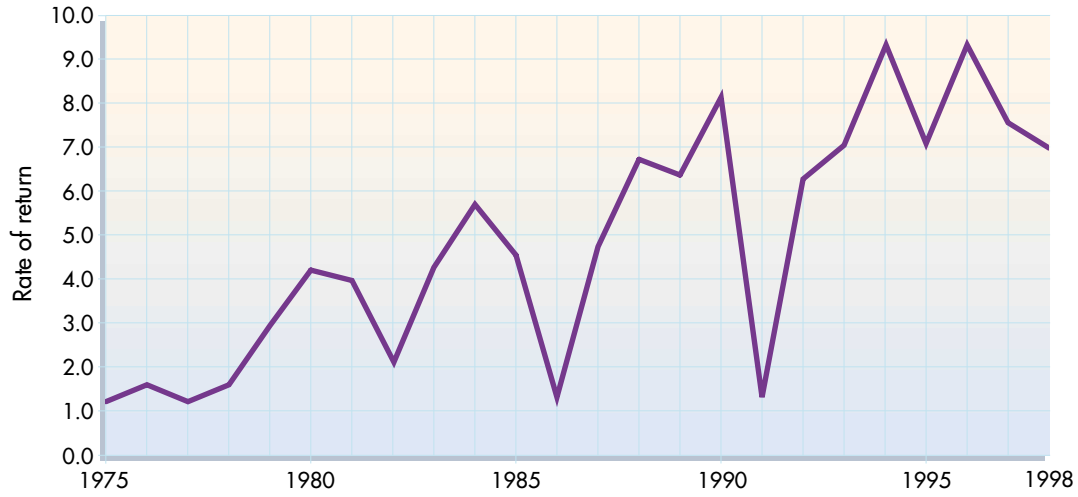
The Staggers Act was the springboard for the U.S. railroad industry. From 1980 to 1998, rail freight rates per ton adjusted for inflation declined an average of 38 percent and Class I (major) freight railroads averaged a 7.5 percent return on their net investment, up from 2 percent in the 1970s (figure 2-43). Figure 2-44 shows the Class I railroad performance indices for labor productivity, revenue ton-miles, revenues, and workforce from 1975 to 1998.

Over the past 20 years, the railroad industry experienced many changes:

1. The industry consolidated, and today, there are eight Class I (major) railroads in the United States. Class I railroads now own approximately 100,000 miles of road (route-miles), down from 192,000 in 1975. Figure 2-45 shows the 1998 volume of freight moved along various route lengths of the rail network, including Class I railroads, regionals, and short-lines.

Figure 2-43

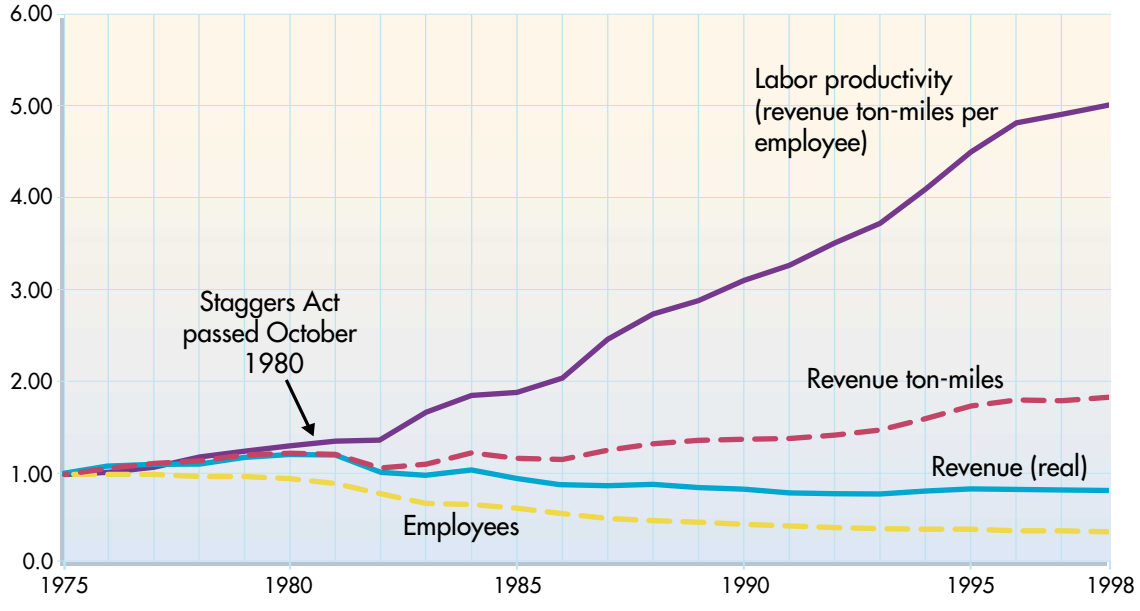
Class I Railroad Rate of Return on Net Investment: 1975-98



Source: Association of American Railroads, *Railroad Facts* (Washington, DC: various years).

Figure 2-44

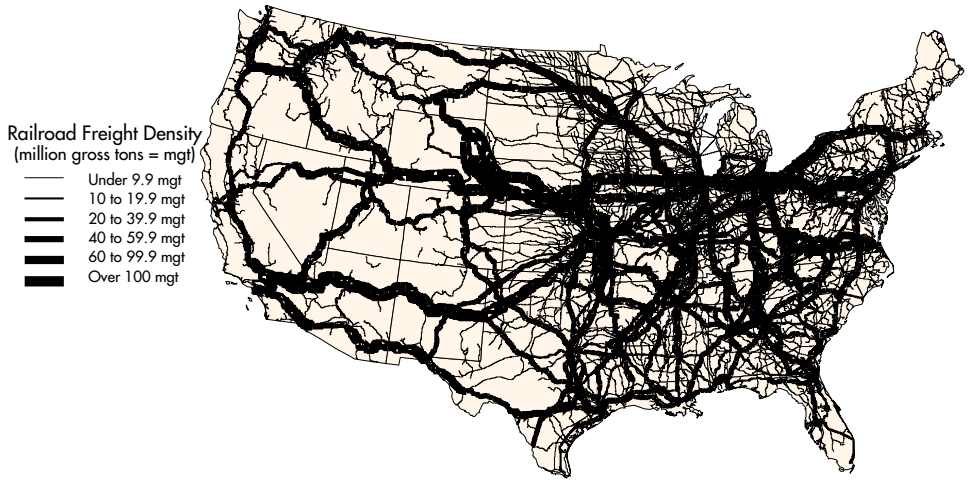
Class I Railroad Performance Indices: 1975-98 (1975 = 1.0)



Source: Association of American Railroads, *Railroad Facts* (Washington, DC: various years).

Figure 2-45

Railroad Network Showing Volume of Freight: 1998



Note: Data for Hawaii are not shown here as they have no freight railroads; data were not available for Alaska.
Source: U.S. Department of Transportation, Bureau of Transportation Statistics, National Transportation Atlas Database 2000 (Washington, DC: 2000).

2. Ninety-one thousand miles of rail line were abandoned or sold by major railroads. Many of the lines were sold to new, aggressive regional and short-line railroads. Regional and short-line railroads operated 50,000 miles of road in 1998 [AAR 2000a].
3. The railroads have undergone productivity growth that far outpaces the American economy as a whole [AAR 2000b].
4. Railroads established connections with trucking and ocean-shipping companies so that today, intermodal traffic has grown from 3.1 million trailers and containers in 1980 to 8.8 million in 1998 [AAR 2000b].

Between 1981 and 1995, the federal government increased funding to the states for rail freight planning and acquisition, rail facility construction, and rehabilitation. The Railroad Rehabilitation and Improvement Financing (RRIF) Program an innovative program of TEA-21, provides loans and loan guarantees for railroad capital improvements to state and local governments, corporations, railroads, and joint ventures that include at least one railroad for the first time ever in the rail industry.

The resurgence of the freight railroads proved so successful that Conrail was privatized in 1987. At that time, this was the largest initial public offering ever made in the nation's history. In 1999, Conrail was absorbed by CSX and Norfolk Southern in a historic consolidation tying East Coast and Midwest freight traffic to the South through two different systems.

Today, the overall challenges facing the railroad industry is to address issues of safety, congestion, productivity, and cost in an environment of ongoing mergers and consolidation. As the industry moves increasingly to consolidation, it is critical to maintain the competitiveness of the rail industry.

Keys to the Future

The Federal Railroad Administration expects rail ton-miles to increase from an estimated 1.46 trillion in 2000 to 2.40 trillion in 2025 and the rail freight industry to grow an average of 2 percent per year between now and 2025. This growth reflects the adoption of technological advances in communications, command, and control; more fuel-efficient locomotives; high-capacity, lightweight freight cars; and moderate traffic growth, led by intermodal traffic.

In this decade, the industry's movement toward mergers is expected to continue, and the number of major railroad systems may be reduced from today's seven to as few as two transcontinental railroads. There is uncertainty over the structure the railroad industry will take, however, in large part due to uncertainty over what rules will ultimately be applied to future railroad merger applications. Currently, there is a proceeding underway, initiated by the Surface Transportation Board (STB) proposing a rewrite of the merger rules. These proposed changes would require applicants to explore the consequences of possible merger activities of other railroads, provide service assurances to shippers, and enhance competition for the first time ever. The final rule, due in June 2001, will influence the speed and extent of future railroad mergers.

In the future, there is the possibility that non-railroads could acquire railroad systems and operate them very differently than they are operated today. Innovative transportation companies, such as the United Parcel Service, could acquire railroads to strengthen their multimodal operations and control the railroad's operation rather than be a customer of that railroad as we have historically seen.

The issue of access to rail lines of competing railroads will continue to be contentious. If, to increase competition, access is mandated by either the STB or Congress, the owning railroads could be faced with reduced financial ability due to more complex operations, and worsened service. Alternatively, such access could provide improved service if the additional carrier can provide innovative, low-cost service. The pricing of access is critical in order not to discourage the owning railroad from investing in roadway.

With increased financial pressures on the major railroads to provide improved service and reduce cost, one solution is to expand capacity. This is possible through adoption of technological improvements, such as Positive Train Control. In addition, out of financial necessity, these railroads may be more amenable to an increased federal government role in funding projects that provide both public and private benefits.

Aviation System

In 1975, the Civil Aeronautics Board (CAB) controlled market entry by new airlines, regulated cargo rates and passenger fares, provided government subsidy to airlines, and controlled interairline relations, such as mergers and agreements.

In 1978, the U.S. Congress passed the Airline Deregulation Act, ending four decades of economic regulatory policy that governed the development of domestic air transportation. Prior to 1978, air regulation came under intense criticism from academic economists, and later by lawmakers, who wanted open competition in the air industry to replace government control of entry, exit, pricing, and other industry structures. The 1978 Deregulation Act created conditions for competition, removed restrictions on domestic service entry, allowed market-based fares and pricing, made changes to antitrust laws to conform to general antitrust principles, recognized the need to continue service to small communities, and abolished the CAB [Brenner et al. 1985].

Deregulation changed the air industry structure, both in terms of the airlines offering services and the nature of the services offered. One major change in airlines' operations is the change in route structure from a linear point-to-point network, in which airplanes flew through a series of points collecting passengers along the route, to a hub-and-spoke network. The primary advantage of the hub-and-spoke network is that it allows airlines to connect several origins with multiple destinations without having all points directly connected. "Hubbing" allowed carriers to serve more markets without having to increase fleet size and seat capacity on flights to and from smaller cities, although total miles traveled could be higher. The hub-and-spoke system cut airline operating costs and allowed airlines to create more compre–hensive networks to efficiently serve many different city-pair markets. It also resulted in fewer

direct flights to destinations and allowed airlines to establish dominance at their hubs. Before deregulation, there were only a few airports with limited hub-and-spoke operations for the major carriers, including Atlanta, Chicago O'Hare, Denver, Dallas/Fort Worth, Minneapolis, New York, and St. Louis. At present, there are more than 20 airports designated as hubs by the major carriers (table 2-7).

Major airlines also withdrew from small markets to focus on their hub-and-spoke systems. At the end of 1978, large U.S.-certified airlines served 473 airports in 49 states and the District of Columbia (there was no service in Delaware) [USDOT FAA 2000a]. By the end of 1998, only 260 airports were served by large commercial air carriers [USDOT FAA 2000c]. This gap has been filled by regional airlines.

There has been a growing concentration of market share among the largest airlines. In 1999, the four most dominant airlines measured by enplanements were Delta Air Lines, United Airlines, American Airlines, and Southwest Airlines. The four largest carriers increased their percentage of total system enplanements from 40.7 percent in 1978 to 53.1 percent in 1998 (figure 2-46). The four largest carriers also significantly increased their share of total RPMs, expanding from 43.5 percent in 1978 to 65.3 percent in 1998 [USDOT BTS OAI n.d.(b)].

Small communities that lost airline service due to deregulation received subsidized services through the federal Essential Air Service program. When the program was started in 1978, 383 communities received subsidies. As of July 2000, 106 communities still receive subsidies, with 30 of those communities located in Alaska [USDOT Office of Aviation Analysis 1998].

While the major airlines implemented their hub-and-spoke systems, other parts of the commercial air carrier industry also changed:

1. The advent of Southwest Airlines extended the system it used in the unregulated intrastate Texas market, creating a model for new low-fare entrants. Cities across the country sought service from Southwest.

Table 2-7

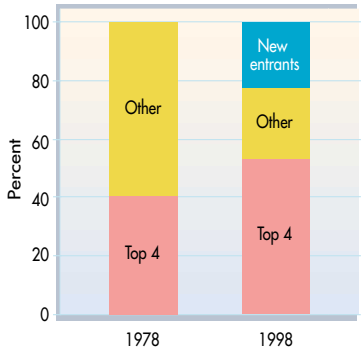
Airline Domestic Hubs

United	Chicago (O'Hare) Los Angeles San Francisco Washington, DC Denver
Northwest	Minneapolis/St. Paul Detroit Memphis
Continental	Houston New York/Newark Cleveland
U.S. Air	Philadelphia Pittsburgh Charlotte
TWA	New York (JFK) St. Louis
America West	Phoenix Las Vegas Columbus, Ohio
Alaska	Seattle Los Angeles Portland Anchorage

Source: Airline websites, as of August 2000.

Figure 2-46

Top Four Largest Carriers' Enplanements: 1978 and 1998



Source: U.S. Department of Transportation, Federal Aviation Administration, *Working Paper on Aerospace Capacity and Demand* (Washington, DC: 2000).

2. Following Southwest's marketing strategy of focusing on short-haul routes and low-fare pricing, new entrants frequently served smaller and less used airports in metropolitan areas, cutting their operating costs and reducing the threat of congestion that would cause delays. In 1999, at least eight new airlines filed applications with the USDOT to begin scheduled domestic passenger jet operations [USDOT BTS OAI n.d.(b)].
3. New regional carriers, designated as commuter carriers prior to 1978, linked smaller markets to the major airlines' hub-and-spoke systems. These markets had frequently faced a loss of service as the major airlines consolidated to their hubs. The regional jets can carry up to 70 passengers, cruise at speeds of more than 500 mph, and have a range of about 800 miles, all significant improvements over earlier turboprop aircraft.
4. To provide small and medium communities with connecting service to and from large hub airports, to create traffic to feed their hub airports, and to maintain their market share, established airlines entered into code-sharing relationships with regional carriers.
5. Major airlines also created new, low-fare subsidiaries such as Delta Air Lines, Delta Express, U.S. Airways' Metro Jet, and the United Airlines Shuttle to compete with the new entrants.
6. Applying information technology, airlines implemented "yield management systems," which allowed them to sell different seats on the same flights for widely varying prices. Although purchase conditions were frequently complex, business travelers who purchased tickets closer to flight times generally paid significantly more than travelers who bought their tickets well in advance.

Deregulation also had a positive impact on fares. Between 1978 and 1998, real airfares have declined by more than 30 percent in domestic markets and by 43 percent in international markets, helping to create a mass market for air travel [USDOT BTS OAI n.d.(b)]. As a result of declining fares, the industry yield (revenues per RPM) has declined (figure 2-47), but the airlines remain profitable.

A 1999 USDOT study found that from 1979 to 1997, inflation-adjusted average fares increased 26 percent in short-haul markets without low-fare competition, but declined 36 percent in markets with competition [USDOT FAA 2000a]. The study also found differences in traffic growth. In short-haul markets with low-fare competition, passenger traffic has nearly quadrupled since 1979—an increase of 60 million passengers [USDOT 1999a]. Traffic in other short-haul markets grew by only 48 percent, or 26 million passengers, over the same period [USDOT FAA 2000a].

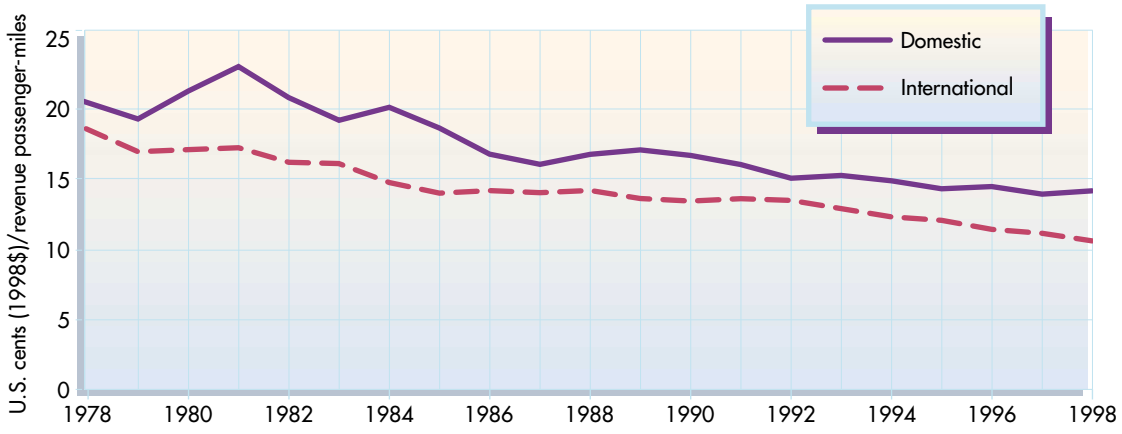
An analysis of 50 city-pairs representing a geographic sample of short- and long-haul markets, as well as travel in and between large, medium, and small hub airports, found variations in fare trends. Between 1979 and 1998, real fares increased in 16 of the 25 markets that were less than 700 miles apart. However, during the same time period, real fares declined in 21 of the 25 markets more than 800 miles apart and in 14 of the 15 city-pairs more than 1,100 miles apart [USDOT BTS OAI n.d.(b)]. Under regulation, short-haul fares were kept artificially low and were cross-subsidized by higher long-haul fares.

Keys to the Future

The issue of competition remains a major issue in the aviation industry. We must address growing concern by new-entrant airlines that major airlines have used anticompetitive practices to drive them out of markets. The USDOT and the Department of Justice (DOJ) have both taken steps against anticompetitive actions, including a USDOJ antitrust suit against American Airlines for anticompetitive actions on four routes from its Dallas-Ft. Worth Airport

Figure 2-47

International and Domestic Yield: 1978-98



Source: U.S. Department of Transportation, Federal Aviation Administration, *Working Paper on Aerospace Capacity and Demand* (Washington, DC: 2000).

hub. The USDOT identified best business practices, which airports could undertake to assure access to new entrants and carriers seeking to expand their service. A new law requires USDOT to analyze airports' competition plans in response to the AIR-21 [Public Law 106-181].

While deregulation has provided higher levels of service and lower fares to much of the country, certain areas have received fewer benefits. Travelers in some mid-sized cities on the East Coast and in the Midwest have experienced limited service and pay relatively high fares on certain routes. Since low-cost, convenient airline service is now a major factor in economic growth and our quality of life, provision of adequate air service to these communities remains an issue to be addressed.

Our efforts will continue to improve the efficiency of our air transportation system and enhance domestic competition so that the American public in all communities will reap the benefits of deregulation. We have to be visionary and vigilant to ensure that industry restructuring and alliances bring greater benefit to all air travelers. At the same time, we have to ensure that the regulatory environment does not curtail the profitabiliy of the industry.

Maritime

In 1975, the shipping liner industry operated on a regulated system of conferences established in the 19th century. These conferences were voluntary associations of ocean carriers that served as rate-setting mechanisms globally or on particular trade routes. Conferences also attempted to ensure strong support for national flag carriers.

The Shipping Act of 1916 endorsed antitrust immunity for conferences and adopted the concept of "common carriage" (all shippers, small or large, must be treated equally by carriers) as its guiding principle. This law regulated the ocean-shipping industry for the next 68 years. Meanwhile, technological advances in the industry, especially containerization, dramatically improved the industry's productivity in the 1960s.

The advent of containerization and the growing uncertainty about the future of the conference system led to calls for reform, culminating in the Shipping Act of 1984. This Act allowed the conferences to engage in collective ratemaking activities, but provided Federal Maritime Commission (FMC) oversight. The FMC's primary responsibility is to "protect the nation's oceanborne trade from unfair treatment by foreign governments and to ensure that carrier

agreements do not unduly impair competition or adversely affect service or rates." The Commission also is charged with monitoring the rates and practices of carriers owned or controlled by their respective governments.

Box 2-8

The Jones Act

After World War I, Congress enacted the Merchant Marine Act of 1920, Section 27 of which is known as the Jones Act. The purpose of the Jones Act was to maintain reliable, domestic shipping services and to ensure the availability of the domestic merchant marine industry to U.S. armed forces in times of national emergency. The Jones Act fleet is a central component of American military sealift. More than 75 percent of the self-propelled ocean-going vessels over 1,000 gross tons in the Jones Act fleet are militarily useful. Approximately 124,000 U.S. citizens are employed under the Jones Act maritime industry's vessel crews or on shore-side jobs.

During the past 25 years, opponents frequently targeted the Jones Act for repeal. However, supporters focusing on national security impacts and economic implications have succeeded in preserving the Act.

The Jones Act requires U.S.-built, -owned, and -registered vessels to be used in waterborne commerce along the inland waterways, across the Great Lakes, along the U.S. seaboard, and between the U.S. mainland and noncontiguous U.S. states and territories. This practice is known as cabotage and has been part of U.S. policy since 1789. Cabotage also is common in most maritime nations; more than 40 industrial nations have cabotage laws similar to those of the United States.

During the 1990s, the shipping industry underwent major consolidation in an effort to improve the efficiency and productivity of the industry. Some of the important mergers were P&O Container and Nedlloyd, Neptune Orient and APL Ltd., and Sealand and Maersk. Liner carriers are currently using vessel-sharing arrangements with other carriers to improve productivity. As a result, individual companies have less need to provide direct services to multiple ports. Carriers can move cargo through a limited number of hub ports and use other intermodal transportation, such as train, air, truck, or vessel feeder services, to connect the hub with the cargo's ultimate destination or origin. In the United States, the ports of Long Beach and Los Angeles in California are the largest container hub ports in North America. Table 2-8 shows the hub ports in various world regions.

Under pressure for deregulation from the shipping industry, the U.S. Congress passed the Ocean Shipping Reform Act (OSRA) in 1998. OSRA allows shippers and ocean carriers to enter, for the first time, into confidential service contracts that must be filed only with the Federal Maritime Commission. Under previous Acts, the carriers had to share this infor-mation with all other shippers, small or large, who could then demand similar rates from ocean carriers. Now rates may be negotiated on a case-by-case, one-to-one

Table 2-8

World Container Port Ranking: 1998

Container traffic, TEUs* (000s)			
Rank	**Port**	**Country**	**TEUs**
1	Singapore	Singapore	15,136
2	Hong Kong	China	14,582
3	Kaohsiung	Taiwan	6,271
4	Rotterdam	Netherlands	6,004
5	Busan	South Korea	4,539
6	**Long Beach**	**USA**	**4,098**
7	Hamburg	Germany	3,588
8	**Los Angeles**	**USA**	**3,378**
9	Antwerp	Belgium	3,266
10	Shanghai	China	3,066
11	Dubai	UAE	2,804
12	Tokyo	Japan	2,495
13	**New York/New Jersey**	**USA**	**2,466**
14	Giola Tauro	Italy	2,126
15	Yokohama	Japan	2,091

*TEUs = 20-foot equivalent units.

Source: Mark Lambert et al., *Containerization International Yearbook 1999* (London: Emap Business Communications, Ltd: 1999).

basis between shippers and carriers. This deregulation may eventually lead to disbanding of the conferences because they would effectively be unable to set rates. OSRA strengthens provisions that prohibit unfair foreign shipping practices and provides greater protection against discriminatory actions. It could also lead to another round of consolidation in the industry.

In 1999, the USDOT collaborated with other federal agencies to develop a bold and comprehensive plan to modernize our nation's Marine Transportation System (MTS), as required in the U.S. Coast Guard Authorization Act of 1998. The MTS vision is to be the world's most technologically advanced, safe, secure, efficient, globally competitive, and environmentally responsive system for moving people and goods by 2020.

Keys to the Future

The consolidation of ocean liner-shipping companies and vessel-sharing activity has raised questions about the importance of nationality among carriers, as well as concern that national and economic security could be weakened by the blurring of carrier nationalities. We are likely to face questions about the extent of the liner-carrier industry's globalization through the consolidation process.

The full effect of the 1998 changes is not yet clear, but the liner industry's trend is toward hub ports. Major carriers, many of them newly consolidated, are using only a limited number of ports and employing intermodal transfers to connect with other locations. This trend emphasizes the importance of intermodal connections at ports and also raises questions about future investment in nonhub ports.

Intermodal Freight Transportation

The U.S. transportation system, responding to domestic economic growth, global competition, and advances in information and production technologies, has undergone major changes in the freight transportation industry—what is being transported, how it is transported, and the origins and destinations of the transported goods. This section looks at how these changes have evolved over the last quarter century, particularly intermodalism. Intermodalism is a term used to describe the movement of freight through the transportation system using two or more modes that interconnect and interchange, allowing timely and cost-efficient delivery.

This section also discusses the growth in container use; the rise in global markets; shifts from a manufacturing to a service economy; a general shift from a supplier-driven, high-inventory freight logistics ("push") system to a consumer-driven, low-inventory, just-in-time freight logistics ("pull") system; and e-commerce. See Chapter 5 for a similar discussion of the changes in the passenger transportation industry.

Advances in technology and efforts to improve productivity led the move to intermodal freight shipments. During the past 25 years, motor carriers, railroads, and ports have invested in container facilities as they recognized the efficiency of containerized transport. Growth in container transportation worldwide and associated developments by railroads and ports have resulted in growth in intermodal transportation. The growing demand for intermodal transport has also spurred demand for larger, specialized container ships and enough intermodal capacity to handle increased landside traffic. Today, an increasing proportion of cargo from the Pacific Rim moves through West Coast container ports, particularly Los Angeles and Long Beach, for destinations not only on the west coast, but throughout the nation.

Freight movement is increasingly becoming "mode invisible" with performance (time, cost, and reliability) determining the choice of mode or modes. The ability to interchange goods

between modes in a timely, cost-effective manner (primarily through containerization) has become crucial to measuring system performance. Today, freight transportation logistics goals are performance-based, rather than modally based, and the ability to interconnect and interchange among modes to optimize the end-to-end movement of freight is vital. At the same time, the individual modes continue to fill market niches (e.g., high-speed, or low-cost), within an intermodal framework.

In 1975, waterborne commerce dominated international trade tonnage and value. Trucking was the leading mode of domestic freight transportation from the standpoint of value, while rail was the leader in terms of ton-mileage. Domestic waterborne commerce via barges along the inland waterways, Great Lakes, and coastwise routes was important, but handled less tonnage and value than either truck or rail. The intermodal container, first introduced in 1956 for domestic ocean/truck services, began a period of accelerated growth. However international container shipping had not begun its period of explosive growth, and domestic intermodal and doublestack rail services had not been initiated.

Today, water continues to handle more international cargo by value, and substantially more international cargo by weight, than any other mode. But, growth in high-value trade with Canada and Mexico (principally by truck, but also by rail and pipeline) has led to a substantial share of U.S. international trade by value for trucks. Growth in the global market for high-value, time-sensitive goods also has led to a substantial international trade value for air cargo. Domestically, trucks still carry more freight by value, and rails carry more ton-miles. Trucks increased their share of intercity tonnage, while river barges and Great Lakes and coastwise shipping had a slightly reduced share (although actual tonnage increased). In terms of ton-miles, both rail and truck increased their share of total movement, while the waterways remained relatively constant. Figure 2-48 shows domestic ton-miles of freight from 1975 to 1997. Figure 2-49 shows the domestic ton-miles of freight moved by different modes during the same period.

To assemble the most efficient intermodal freight system, carriers have diversified and, in many cases, consolidated. Companies, such as FedEx, UPS Worldwide Logistics, Hub Group Logistics, Schneider Logistics, and Ryder Dedicated Logistics, have created air-truck, rail-truck, ocean-truck, and ocean-rail combinations to become the leading players in domestic and worldwide freight movements.

Box 2-9

Intermodal Transportation and Supply Chains

Intermodal transportation, with options for integrating multiple modes, provides a flexible response to the changing supply chain management requirements in global markets and distribution systems. Integrating modes requires a process or systems approach for execution and a higher degree of skill and broader knowledge of the transportation/supply chain processes—information, equipment, and infrastructure. Intermodal transport, as it moves from a focus on infrastructure components to a holistic focus on process or systems, will have more viability and applicability in the world of global supply chain management.

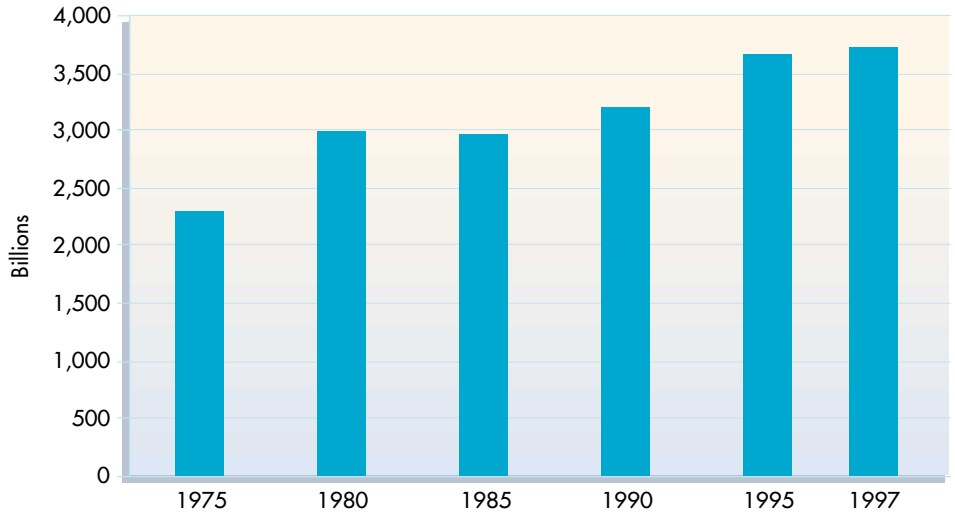
A supply chain is defined as a set of three or more organizations directly linked by one or more of the upstream and downstream flows of products, services, finances, and information from a source to a customer. Supply chain management is defined as the systematic, strategic coordination of the traditional business functions and the tactics across these business functions within a particular company and across businesses within the supply chain, for the purposes of improving the long-term performance of the individual companies and the supply chain as a whole.

It is in this time of information and communications technology and capability that the supply chain processes, and the modes supporting those processes, are gaining the capability of being integrated.

Source: W. DeWitt and J. Clinger, *Intermodal Freight Transportation*, Transportation Research Board, Transportation in the New Millennium (Washington, DC: 2000).

Figure 2-48

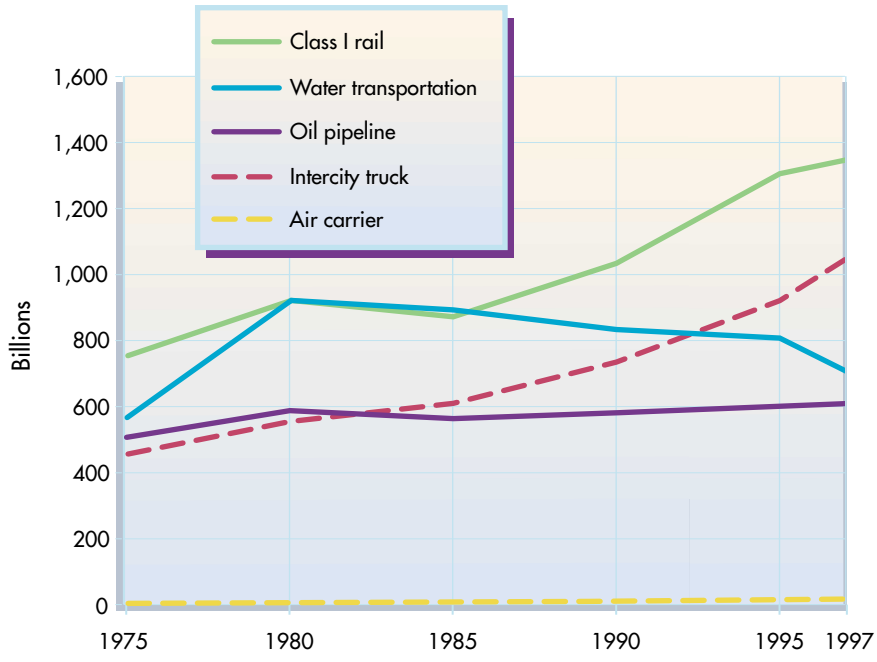
Total Ton-Miles of Freight: 1975-97



Source: U.S. Department of Transportation, Bureau of Transportation Statistics, *National Transportation Statistics* (Washington, DC: 1999).

Figure 2-49

Domestic Ton-Miles of Freight: 1975-97



Source: U.S. Department of Transportation, Bureau of Transportation Statistics, *National Transportation Statistics* (Washington, DC: 1999).

National to Global Markets

The U.S. freight system has been driven by the rapid growth of international trade, which has influenced the development of marine cargo facilities, air cargo facilities, land border crossings, and domestic access infrastructure to connect these international ports of call with domestic U.S. origins and destinations.

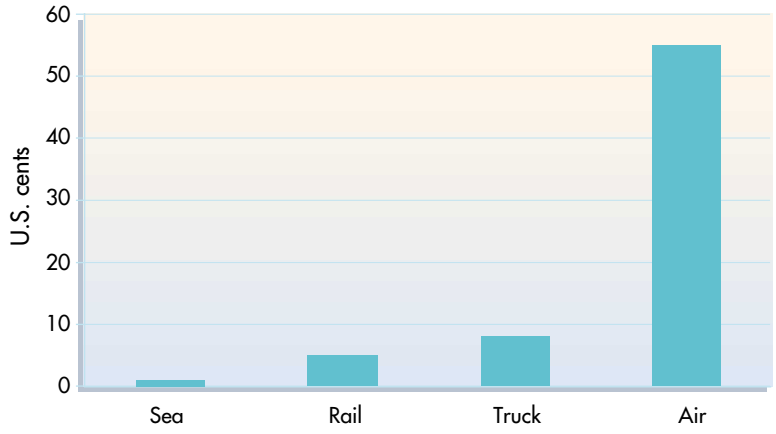
In 1975, U.S. freight transport was organized to serve regional and national markets. With much of the Interstate highway system (IHS) in place by 1975, businesses had built a truck freight system organized around regional and national supply chain and distribution networks. Trucking had displaced the railroads as the dominant mode of domestic freight transportation, just as the railroads had displaced the riverboats and barges a century earlier. In most cases, trucking was more flexible and more time-sensitive than rail service, and could provide customized service to manufacturers and distributors. Domestic truck transportation accounted for a growing portion of the nation's total freight shipments by value, although railroads carried more by tonnage.

In 1975, international trade accounted for a modest portion of total U.S. freight movements with the majority of this trade moving between Europe and east coast ports. Cross-border trade with Canada was growing, especially among automobile manufacturers, but trade with Mexico and Latin America was limited. A wave of growth in expanding global markets was being felt on the west coast, where the surge in trade with Japan and Korea was reshaping the west coast ports and transcontinental rail service.

Today, the continuing growth in international trade has sparked a push for upgraded seaports, airports, rail terminals, border crossings, air cargo facilities, and navigation channels, as well as the highway and rail access corridors needed to support them. Water transport carries the most international cargo by weight and also by value, because it is the most inexpensive mode of transportation (figure 2-50). Air cargo also hauls a growing share of international trade by value, stemming from the growth in the global market for high-value, time-sensitive goods. Trucks, taking advantage of the growth in trade with Canada and Mexico, also move a substantial share of international trade by value.

Figure 2-50

Average Cost of Transporting One Ton One Mile: 1998



Source: K.C. Sjetnan, 1999, *Cargo Systems, The Future of the Container Shipping Industry* (London: IIR Publications, Ltd.).

Japan and Korea are still our major western Pacific trading partners, but the Asian market has expanded to encompass China and some Southeast Asian nations as our top trading partners. Despite the recession in East and Southeast Asia in 1997, the volume of freight in the Pacific trade continues to grow and is triggering additional port expansions around the Pacific Rim.

The North American Free Trade Agreement (NAFTA) has increased trade between the United States and Canada, and between the United States and Mexico. The European Union (EU) and NAFTA experience has spurred the formation of the MERCOSUR (Southern Common Market) free-trade agreement among the major South American economies, as well as a series of ongoing negotiations to integrate the Caribbean and Latin American economies into a broad trade zone of the Americas.

Manufacturing to Service-Based Economy

The types of commodities moved on the freight system are directly related to the structure of our economy, which determines production and consumption patterns. Over the past 25 years, the U.S. economy has expanded its industrial output while evolving to an information and service-based structure.

The U.S. economy in 1975 was transitioning from a manufacturing economy to a service economy. It was recovering from the economic and social impacts of the Vietnam War, but growth alternated with periods of sharp recessions. Unstable fuel supplies and prices sent shock waves through the economy, dampening domestic and international trade.

The U.S. economy was losing manufacturing jobs to the booming, low-wage Asian economies. Traditional manufacturing jobs were being replaced by jobs in the growing service industries (i.e., business services, health services, and finance), and in the technology sector. The resultant economic pressures resulted in a massive restructuring of the U.S. business enterprise. By 1975, businesses were lobbying for lower freight transportation costs and better freight services to facilitate establishment of manufacturing facilities abroad.

Today, the economy's service sector is larger than all other sectors in output and growth potential. It also has fueled the longest period of economic expansion in U.S. history. The service-producing sectors of the economy now account for about two-thirds of the nation's economic output and three-quarters of its jobs. This economy is slowly shifting from mass manufacturing and distribution toward custom manufacturing and retailing—a world of mail-order houses and overnight delivery.

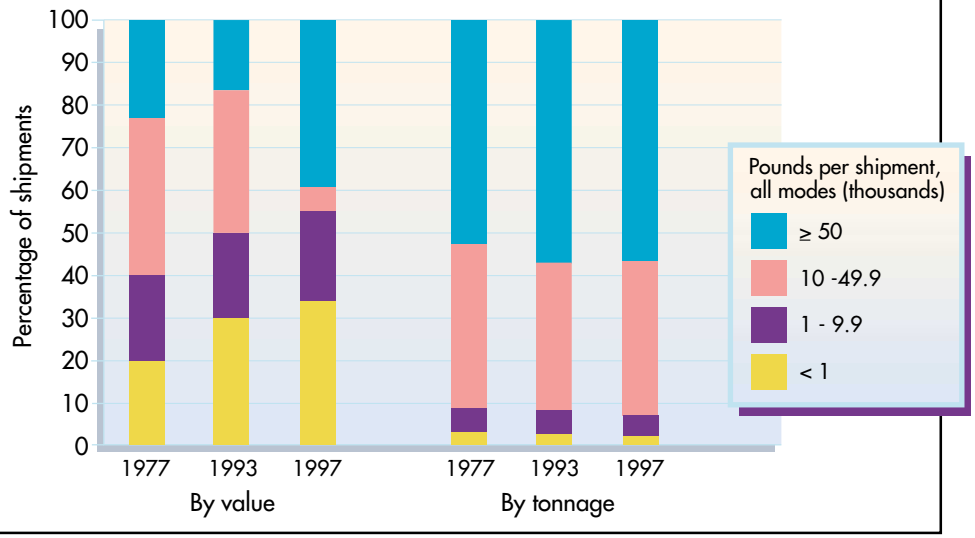
These changes in the U.S. economy have transformed the nature of the freight moved in both domestic and international markets. More freight is being moved over longer distances. This freight is lighter (with more frequent shipments) and higher in value, on average, than it was 25 years ago (figure 2-51).

The cost per unit of moving freight has dropped significantly from 25 years ago. Total logistics costs (e.g., transportation, warehousing, administration, and insurance) account for a significantly smaller proportion of the GDP than in 1975. Inefficient freight operations have been reorganized and new logistics practices adopted.

The relative shares of U.S. domestic versus U.S. international freight movement have also changed. Domestic freight still accounts for the dominant share by volume and value, but the share of international freight by value is growing.

Figure 2-51

Freight Shipments by Value and Tonnage: 1977, 1993, and 1997



Note: 1977 data limited to primary shipments of manufactured goods.
Source: U.S. Department of Transportation, Bureau of Transportation Statistics, Commodity Flow Survey data (Washington, DC: Various years); and U.S. Department of Commerce, Census Bureau, Commodity Flow Survey data (Washington, DC: Various years).

Just-In-Time Systems

Another critical element of freight transportation is the relationship between consumer and producer, which encompasses the logistics decisions a producer makes to optimize performance, customer service, and profitability. Today's businesses often require higher priced, higher quality transportation to assure timely product deliveries with little product loss or damage. As business manufacturing and delivery practices have changed, so too have transportation modes to fit a dynamic economy moving toward lower overall production and distribution costs.

The logistics system of 1975 was a "push" system. Manufacturing, distribution, and retailing were organized to support mass production, warehousing, and retailing.

In the push system, large hierarchical corporations used centralized design, production, and marketing to achieve economies of scale. These integrated manufacturers purchased materials and components from suppliers in large batches. Long production runs by the manufacturer generated large inventories of finished products, which were warehoused by distributors until shipped to retailers and customers. Throughout the process, large inventories were maintained to buffer against changes in supply and demand cycles. Transportation was organized to move goods through the logistics chain from supplier to manufacturer, to distributor, and to the retailer. Each link was operated independently and managed and priced within strict guidelines.

Today, the logistics system is increasingly a "pull" system. Retailers, distributors, manufacturers, and suppliers track customer demand daily and hourly through point-of-sale cash registers and electronic purchase order data interchange. Orders and purchase patterns pull goods through the supply chain. Increasingly, industries do not produce parts and final products until an order is placed, giving rise to just-in-time manufacturing and retailing systems.

This shift from a "push" to a "pull" system is a result of the information revolution brought about by computer and communication technologies. The "pull" system tailors products and delivery to consumers' needs and business cycles. The risk of over- or under-production is reduced, as is the need to maintain large, costly inventories.

The information revolution and the "pull" logistics system have reshaped freight transportation. With improved communications and control, manufacturers and retailers have substituted more frequent and longer distance transportation services to obtain lower cost labor and supplies. This pressures carriers to provide integrated and intermodal transportation services that are cost-effective, timely, reliable, and can be tracked from door-to-door. Third-party logistics companies (3PLs) have emerged as the dominant brokers of transportation services, often handling the whole freight trip from manufacturer to customer. Fourth-party logistics companies (4PLs) are an emerging trend.

Keys to the Future

The rate of public investment in domestic freight infrastructure is lagging behind changes in freight movement patterns. Growth in government investment in intermodal connectors providing access to ports, airports, marine terminals, rail terminals, and truck terminals has not kept pace with growth in international and domestic freight and changing logistics strategies of business and industry, creating even greater needs for public - private partnerships and investments.

The nation's highway and rail freight systems, which were developed for the east-west trade, are being strained by the north-south NAFTA trade, especially at border crossings. Trade flowing from South Asia via the Suez Canal is forcing reinvestment in older east coast ports, and the growth of Latin American trade may soon overwhelm Florida and Gulf ports. The demand for international air cargo service, much of it carried as belly cargo in wide-body passenger planes, could outstrip the supply of planes and ground facilities handling capacity.

Passengers and freight are competing for space on crowded transportation facilities, such as highways, freight railroads, and airports. Freight service will face questions of incompatibility with new high-speed passenger rail. At seaports, containerships compete for space with cruise ships; and on congested highway freight corridors, truck-only lanes, or truckways, may be an option.

Improving intermodal connectors became a focus of federal policy in the 1990s, but new policies and programs may be needed, especially where connectors span many jurisdictions. It may be necessary to examine the financing of local freight-related improvements that provide regional and national benefits.

The public or private sector, or some form of partnership between the two may need to finance building truck staging and rest areas to improve carrier productivity and reduce truck travel in urban settings. There also may be a need to improve staffing, skills, data, and planning tools needed to support freight planning and investment at the federal, state, and local levels.

As U.S. carriers and 3PLs expand globally and foreign operators move into the U.S. transportation market, competition will intensify. Governments will be faced with balancing the needs of domestic companies against the free and open international movement of freight. There will be questions of providing support and coordination for efficient operations such as free and fast passage of freight and personnel, standardization of policies affecting equipment and lading, fair access to foreign ports and airports, and protection from subsidized competition.

Box 2-10

Third- and Fourth-Party Logistics

The growth in U.S. freight transportation and the deregulation of transportation services created opportunities for new transportation services, increased competition among transportation service providers, and changed the relationships between shippers, consignees, carriers, and intermediaries. These changes, in part, led to the emergence of third-party logistics (3PL) service providers in the early 1980s and, more recently, to fourth-party logistics (4PL) providers.

As production, distribution, and customer expectations changed, so did firms that provide logistics services. In 1980, a third-party logistics service described a for-hire provider that performed outsourced functions, such as carrier selection, warehousing, rate negotiations, and freight payments. Today, these companies provide more services, including logistics information systems, inventory management, customer order management, and real-time information feedback to customers.

Fourth-party logistics service describes a for-hire provider that manages an entire supply chain by integrating the resources, capabilities, and technology of its own firm with those of complementary service providers to deliver a comprehensive supply chain solution to customers. These firms provide value-added services beyond the traditional logistics functions, such as business strategy consulting, business redesign, technology integration, management of multiple service providers, and migration to e-systems.

Today, the average number of outsourcing relationships with logistics providers has risen to more than 6 per company in certain industries, with more than 50 percent of Fortune 500 companies having at least one contract with a 3PL provider. Industry estimates indicate that, by 1999, gross revenues for outsourced logistics totaled nearly $46 billion and are expected to increase rapidly in coming years.

Industry consolidation and e-commerce are two key factors that will change the future of 3PLs and 4PLs. For the immediate future, industry experts speculate that major acquisitions and mergers of 3PLs in Europe in 1999 may spark a similar trend in the domestic U.S. logistics market. Providing superior solutions to manage the logistics needs of Dot-Com retailers and the business-to-consumer market will determine how competitive 3PLs and 4PLs will become in the ever-expanding global marketplace.

Sources: Logistics Management and Distribution Report, 2000 Annual Report Online; S. Boyson, T. Corsi, M. Dresner, and E. Rabinovich, Managing Effective Third Party Logistics Relationships: What Does It Take?, *Journal of Business Logistics*, vol. 20, no. 1, pp. 73-100 (1999); T. Prince, Onward in the Brave New World of Logistics, *Journal of Commerce*, available at http://www.joc.com/, as of Aug. 20, 2000.

Concerns exist about the effect of the concentration of market power in a small number of private 3PLs and retail distribution companies. Competition resulting from economic deregulation could be undone by the market dominance of a limited number of carriers or 3PLs or both.

With 3PLs emerging as the new business model for transportation and logistics, questions exist concerning their impact on competition and safety and whether there is a need for additional or redesigned regulation. Further changes in regulation may be needed to respond to the industry's shift to shared containers and truck chassis, vessel-space chartering agreements, and expanded use of independent owner-operators.

After two decades of consolidation, the rail industry may face questions about open access in order to produce competition at a time when there are pressures for transcontinental rail freight systems. There also are questions of whether regulatory streamlining of customs clearance operations and truck size, weight, and safety enforcement will keep pace with market growth and freight movement.

We may have to consider workforce-related issues, such as shortages of trained truck drivers (each driver turnover costs about $8,000 in replacement and training costs) and railroad engineers, worker training, and modifications of work rules.

Despite significant gains, some challenges remain because of global trends. Our nation has become an increasing part of a global economy and has expanded its manufacturing capability, while transforming itself to a largely service-based economy. The relationship between consumer and manufacturer has become much more direct, with shorter production cycles and delivery times, increased customization, and sharply reduced inventory. Advanced information technologies and e-commerce have enabled better control over material and information and facilitated business-to-business and business-to-consumer communications.

The dynamic changes of the past 25 years have created an efficient, market-driven freight system, providing a variety of time-sensitive and lower cost services to consumers and producers. This freight system stimulated the economic expansion of the 1990s and itself was positively changed by the economic growth it helped spur.

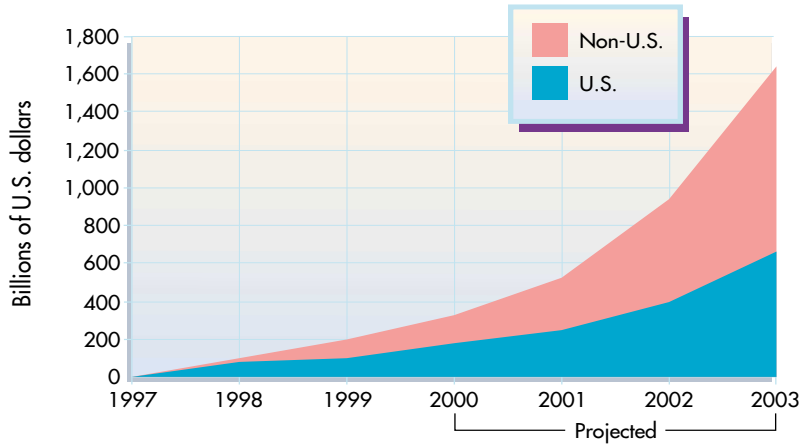
Box 2-11

E-commerce

By expanding marketplaces, the Internet is having a major, if not yet fully realized and understood, affect on business. According to one estimate, e-commerce revenue is expected to top $1,600 billion by 2003 (figure 2-52). The U.S. share of users and revenues is expected to decline somewhat in the future (figure 2-53). E-commerce results in fewer personal shopping trips, but requires more delivery trips. However, the practical impact of e-commerce on transportation is uncertain. As much as 90 percent of e-commerce, appears to be business-to-business (B2B) transactions, rather than business-to-consumer (B2C) sales known as "e-tailing." E-commerce may result in a shift in how goods are purchased, as well as how they are delivered.

Figure 2-52

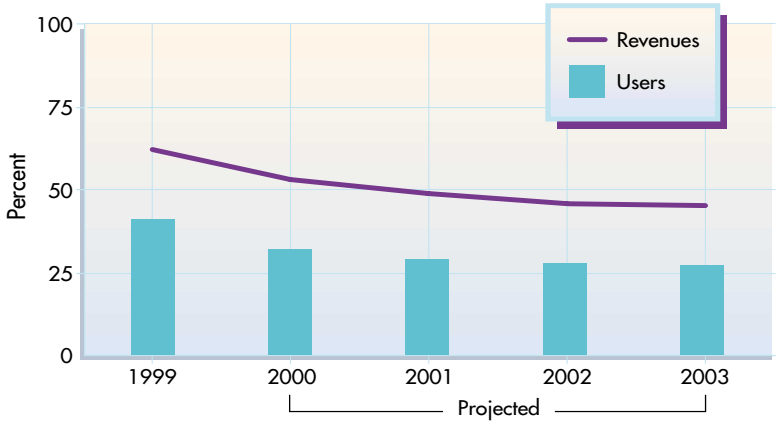
Internet Commerce Revenues: 1997-2003



Source: International Data Corp., EBusiness Trends, *Internet Commerce Market Model,* Vol. 6, no. 1, 2000, available at http://www.idc.com, as of May 15, 2000.

Figure 2-53

U.S. Percentage of Web Users and Internet Commerce Revenues as a Proportion of World Share: 1999-2003



Source: International Data Corp., EBusiness Trends, *Internet Commerce Market Model,* Vol. 6, no. 1, 2000, available at http://www.idc.com, as of May 15, 2000.

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